


Project Manual

South Putnam – New Administration
Building

South Putnam Community School
Corporation
Greencastle, Indiana



Project No. 224171.00
Book 2 of 3
Divisions 03 – 12
April 21, 2025



PROJECT TITLE PAGE

South Putnam – New Administration Building

South Putnam Community School Corporation
Greencastle, Indiana

Project No. 224171.00

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END OF PROJECT TITLE PAGE

CERTIFICATIONS PAGE

TITLE AND LOCATION OF THE WORK

South Putnam – New Administration Building
Greencastle, Indiana 46135

NAME AND ADDRESS OF OWNER

South Putnam Community School Corporation
3999 South U.S. Highway 231
Greencastle, Indiana 46135

NAME AND ADDRESS OF ARCHITECTS/ENGINEERS

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I hereby certify that the Project Drawings and the Project Manual were prepared by me or under my direct supervision and that I am a duly registered Architect/Engineer under the Laws of the State of Indiana.

FANNING/HOWEY ASSOCIATES, INC.
ARCHITECTS/ENGINEERS



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Expiration Date: 12/31/2025
(Architectural)

Date: April 21, 2025

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DIVISION

CONCRETE

SECTION 03 06 30.01 - CONCRETE SCHEDULE

SUBMIT THIS SCHEDULE TO CONCRETE SUPPLIER PRIOR TO BIDDING		
ITEM OR STRUCTURE	FINISH**	CONCRETE CLASS* AND OTHER REQUIREMENTS
Concrete not otherwise indicated	RfFm-Fn SmFm-Fn, if exposed	Class C
Trench footings, footings, and interior foundation and retaining walls	RfFm-Fn SmFm-Fn, if exposed	Class B
Foundation and retaining walls exposed to exterior	RfFm-Fn SmFm-Fn, if exposed, UON Ab-Fn, where noted	Class C Air entrained
Interior formed concrete exposed to view	SmFm-Fn, UON Ab-Fn, where noted	Class C Not air entrained
Noncritical floors and floor slabs to receive mud-set mosaic and quarry tile	Flt-Fn	Class D Provide synthetic fiber reinforcement for non-reinforced slabs on grade
Exposed interior floor slabs and carpeted floors, unless otherwise noted	Tr-Fn1	Class D Provide synthetic fiber reinforcement for non-reinforced slabs on grade
Interior floor slabs scheduled to receive thin-set flooring, resilient flooring and other flooring types, unless otherwise noted	Tr-Fn2	Class D Provide synthetic fiber reinforcement for non-reinforced slabs on grade
Interior floor slabs scheduled to receive wood flooring, and where indicated	Tr-Fn4	Class D Provide synthetic fiber reinforcement for non-reinforced slabs on grade
Exterior walks, stoops, steps, aprons, and curbs; exterior formed concrete exposed to view; exterior concrete not otherwise indicated	NsBrm-Fn (Horizontal) Grt-Cl-Fn (Vertical)	Class S Air entrained
Exterior paving	NsBrm-Fn	Class S Air entrained
Interior Curbs and Equipment Bases	Tr-Fn1	Class B
Flowable Fill – Type 1 Utility Trench Backfill	N/A	50-100 P.S.I. at 28 days Unconfined compression strength per ASTM D4832

Flowable Fill – Type 2 Under Foundations	N/A	100 P.S.I. at 28 days Unconfined compression strength per ASTM D4832
Lean concrete fill under footings and encasement of underground utilities or connections	N/A	Class A

*Refer to Section 03 30 00 – Cast-In-Place Concrete for Concrete Class mix design requirements

**Refer to Section 03 30 00 – Cast-In-Place Concrete for definitions of finishes.

END OF SECTION 03 06 30.01

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for following:
 - 1. Exterior Concrete
 - a. Ramps, steps, and stoops
 - 2. Interior Concrete
 - a. Slab-on-grade
 - b. Bases, curbs, risers, and steps
 - c. Foundations, footings, pads, piers, columns, beams
 - 3. Provide other cast-in-place concrete and related work as indicated for complete and finished work, except concrete work specifically designated to be provided under Work of other Sections of these Specifications.
- B. Related Sections include following:
 - 1. Division 07 Section "Joint Sealants" for sealing joints and penetrations in slab-on-grade or slabs below grade.
 - 2. Division 09 Finish sections for coordination with substrate requirements of finish materials.
 - 3. Division 31 Section "Earth Moving" for underslab subgrade.
 - 4. Division 32 Section "Concrete Paving" for concrete pavement and walks.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with fly ash subject to compliance with requirements.
- B. Water/Cement (W/C) Ratio: Ratio by weight of water to cementitious materials.
- C. Form-Facing Material: Temporary structure or mold for support of concrete while concrete is setting and gaining sufficient strength to be self-supporting.
- D. Formwork: Total system of support of freshly placed concrete, including mold or sheathing that contacts concrete, as well as supporting members, hardware, and necessary bracing.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate with other trades to maintain protection of concrete surfaces scheduled remain exposed. Protect concrete surfaces from physical damage and staining that could result from subsequent construction operations and might compromise final concrete finish.
- B. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 - e. Special concrete finish subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold and hot weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint filler strips, semi-rigid joint fillers, forms and form removal limitations, shoring and reshoring procedures vapor barrier installation, anchor rods and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, methods for achieving specified floor and slab flatness and levelness and concrete protection.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including form coatings, fibrous reinforcement, fly ash, admixtures, curing materials, sealers, floor treatment, and vapor barrier.
 1. Include installation instructions where applicable.
 - a. Vapor Barrier: Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
 2. Admixtures: Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature of time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments. Prepare and submit design mixes for each type of concrete and flowable fill. Use an independent testing facility acceptable to A/E for testing compressive strength of proposed mix designs.
- C. Compressive strength of proposed mix designs: Submit compression test results for each design mix. Test shall clearly indicate design mix for which it applies. Each design mix shall indicate types of structures in which it is to be used.
 1. Sample design mix submittal form is enclosed herein.
- D. Steel Reinforcement Shop Drawings: Comply with ACI SP-066:
 1. Placing drawings that detail fabrication, bending, and placement.
 2. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- E. Formwork Shop Drawings: Prepared by or under supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
 1. Indicate dimension and locations of construction and movement joints required to construct structure in accordance with ACI 301.
 - a. Location of construction joints is subject to approval of A/E.
 2. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
- F. Construction Joint Layout: Indicate proposed construction joints required to construct structure.
 1. Location of construction joints is subject to approval of A/E.
- G. Concrete Schedule: For each location of each class of concrete indicated in "Concrete Mixtures" article, include following:
 1. Concrete Class designations.
 2. Location within project.
 3. Exposure class designation.
 4. Formed surface finish designation and final finish.
 5. Final finish for floors.
 6. Curing process.
 7. Floor treatment if any.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Material Test Reports: For following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
 - 2. Mechanical splice couplers.
- B. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.
- C. Field quality-control test and inspection reports i.e. floor flatness and levelness.
- D. Proposed curing schedule shall include method and duration.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Environmental Requirements: Manufacturer and Contractor shall conform to Federal, State, and Local V.O.C. (Volatile Organic Compound) Regulations in area where Project is located. Notify A/E in writing if variations to Specifications herein are required.
- D. Laboratory Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing including mix design.
 - 1. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- E. Field Quality Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C 1077 and ASTM E 329 for testing indicating.
 - 1. Personnel conducting field tests shall be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.
- F. Regulatory Requirements: Comply with requirements of latest edition or edition approved by authorities having jurisdiction.
 - 1. ACI Publications: Comply with following unless modified by requirements in Contract Documents:
 - a. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
 - b. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - c. ACI 347 "Recommended Practice of Concrete Formwork."
 - d. ACI 318, "Building Code Requirements for Reinforced Concrete."
 - e. ACI 211.1-91 "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete."
 - f. ACI 212 "Chemical Admixtures for Concrete."
 - g. ACI 302.1R-89 "Guide for Concrete Floor and Slab Construction."
 - h. ACI 304R-89 "Guide for Measuring, Mixing, Transporting, and Placing Concrete."
 - i. ACI 305 "Hot Weather Concreting."
 - j. ACI 306 "Cold Weather Concreting."

- k. ACI 308 "Standard Practice for Curing Concrete."
 - l. ACI 311.4R-95 "Guide for Concrete Inspection."
 - m. ACI 544.3R-08 "Guide for Specifying, proportioning, and Production of Fiber-Reinforced Concrete"
 - 2. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".
 - 3. ASTM Intl.:
 - a. ASTM A 1064 "Standard Specification for "Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete."
 - b. ASTM C33 "Standard Specification Curing Concrete."
 - c. ASTM C94 "Standard Specification for Ready-Mix Concrete."
 - d. ASTM C260 "Standard Specification for Air Entraining Admixtures for Concrete."
 - e. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."
 - f. ASTM C309 "Standard Specification for Liquid Membrane – Forming Compounds for Curing Concrete."
 - g. ASTM C779 "Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces."
 - h. ASTM C1018 "Test Method for Flexural Toughness and First-Crack Strength of Fiber-Reinforced Concrete."
 - i. ASTM C1116 "Standard Specification for Fiber Reinforced Concrete and Shotcrete."
 - j. ASTM C1315 "Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete."
 - k. ASTM E1155 "Determining Floor Flatness and Levelness Using F-Number System."
 - l. ASTM F609 "Standard Test Method for Using a Horizontal Pull Slip Meter (HPS)."
 - G. Concrete ramps and curbs shall be provided to conform to Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.
 - 1. Detectable warnings shall conform to ADAAG.
 - H. Mockups: Cast concrete slab-on-grade panels to demonstrate typical joints, surface finish, texture, and standard of workmanship.
 - 1. Slab-On-Ground build panel approximately 225 sq.ft. (area within one set of control joints) in location indicated or, if not indicated, as directed by A/E.
 - a. Divide panel into four equal panels to demonstrate saw joint cutting.
 - 2. Approval panels may become part of completed work if undisturbed at time of Substantial Completion.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Concrete: Comply with ASTM C94 and ACI 301.
 - B. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
 - 1. Store reinforcement to avoid contact with earth.
 - C. Vapor Barrier:
 - 1. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
 - 2. Store materials in a clean, dry area in accordance with manufacturer's instructions.
 - 3. Protect materials during handling and application to prevent damage or contamination.
- 1.8 FIELD CONDITIONS
- A. Environmental Requirements.
 - 1. Floor and Slab Treatments: Follow manufacturer's recommendations for environmental requirements when using floor and slab treatments.
 - a. Do not apply concrete densifier and chemical hardener when concrete temperature is below 35 degrees F or above 135 degrees F.

- B. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows:
1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperature.
 2. When average high and low temperature is expected to fall below 40 deg. F for three successive days, maintain delivered concrete mixture temperature within temperature range required by ACI 301.
 3. Do not use frozen materials or materials containing ice or snow. Do not place concrete in frozen subgrade or on subgrade containing frozen materials.
 4. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
 5. Do not place concrete in contact with surfaces less than 35 deg F., other than reinforcing steel.
- C. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1 and as follows:
1. Maintain concrete temperature below 95 deg. F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without sanding water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
 2. Products: Subject to compliance with requirements, provide one of products specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. Requests for A/E's approval must be accompanied by "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 CONCRETE, GENERAL

- A. ACI Publications: Comply with following, unless modified by requirements in Contract Documents:
1. ACI 301
 2. ACI 117

2.3 FORM-FACING MATERIALS

- A. Smooth-Formed Finished (Exposed) Concrete Form-Facing Material (As-Cast Surface): Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Plywood, metal, fiberglass, or other approved panel materials.
 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- E. Chamfer Strips: Metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
 - 1. Products:
 - a. Greenstreak 622; Greenstreak
 - b. Vinylex CSN-3/4; Vinylex Corp.
 - c. CHM-75-75-110 Poly-Comp Plastic Chamfer; Sylvan Products
 - d. CS-750 Chamfer Former; BoMetals Inc.
- F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 - 2. Products: Subject to compliance with requirements, provide one of following:
 - a. MasterFinish RL 211; BASF Construction Systems
 - b. Crete-Lease 20-VOC; Cresset Chemical Co.
 - c. Clean Strip J1EF; Dayton Superior Corporation
 - d. Asphalt Release; Franmar Chemical, Inc.
 - e. Bio-Form; Leahy-Wolf Co.
 - f. Soy Form Release and Natural Form Oil: Natural Soy, LLC
 - g. SOYsolv; SOYsolv
 - h. Formshield WB; Tamms Industries
 - i. SealTight Duogard II; W.R. Meadows, Inc.
- G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.4 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed for bars No. 3 to 11, unless otherwise noted.
- B. Epoxy-Coated Reinforcing Bars: ASTM A 615, Grade 60, deformed bars, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.
- C. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60, deformed bars, assembled with clips.
- D. Plain-Steel Wire: ASTM A 1064, as drawn.
- E. Deformed-Steel Wire: ASTM A 1064.
- F. Epoxy-Coated Wire: ASTM A 884, Class A, Type 1 coated, as-drawn, plain-steel wire, with less than 2 percent damaged coating in each 12-inch wire length.
- G. Plain-Steel Welded Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets. Note: Roll stock is not acceptable.

- H. Deformed-Steel Welded Wire Reinforcement: ASTM A 1064, flat sheet.
- I. Galvanized-Steel Welded Wire Reinforcement: ASTM A 1064, plain, fabricated from galvanized steel wire into flat sheets. Note: Roll stock is not acceptable.
- J. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884, Class A coated, Type 1, plain steel.

2.5 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Epoxy-Coated Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, ASTM A 775 epoxy coated.
- C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.
- D. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - 3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
 - 4. Over waterproof membranes and vapor barriers, use precast concrete chairs to prevent penetration of membrane.
 - 5. For footings, trench footings, slabs on grade, and grade beams use precast concrete bricks ($f'_c = 3000$ psi min. at 28 days). (Concrete masonry bricks are not acceptable.)
- F. Tie Wire: ASTM A 1064, annealed steel, not less than 0.0508 inch in diameter.
 - 1. Finish: Match finish of reinforcing type being tied, unless otherwise noted.

2.6 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type of class or cementitious material of same brand from same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Material: Use following cementitious materials, of same type, brand, and source, throughout Project:
 - 1. Coordinate with mix design for special finishes.
 - 2. Portland Cement: ASTM C 150, Type I or III, gray. Supplement with following:
 - 3. Limit fly ash to Class F if concrete expansion from alkali silica or alkali carbonate reactions are anticipated.
 - a. Fly Ash: ASTM C 618, Class C or F.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, uniformly graded not to exceed 1-1/2 inch nominal size per ACI 301. Provide aggregates from a single source to ensure uniformity in color, size, and shape with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials. Aggregates shall not be potentially reactive as defined in Appendix X1 of ASTM C33.

1. Local aggregates not complying with ASTM C33, but which have shown by special test or actual service to produce concrete of adequate strength and durability, may be used when acceptable to A/E.
2. Fine Aggregate: Clean, sharp, natural sand free from loam, clay lumps, or other deleterious substances.
3. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
 - a. Crushed stone, processed from natural rock or stone.
 - b. Washed gravel, either natural or crushed. Use of pit or bank-run gravel is not permitted. No pea gravel, river gravel or slag aggregate is permitted.
 - c. Maximum Aggregate Size: Not larger than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourths of minimum clear spacing between individual reinforcing bars or bundles of bars.
 - d. Exterior concrete shall have crushed limestone aggregate, complying with ASTM C33, Class 4S or better.
4. Alkali-Silica Reaction: Comply with one of following:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C 1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C 1567.
 - c. Alkali Content in Concrete: Not more than 4 lb./cu.yd. for moderately reactive aggregate or 3 lb./cu.yd. for highly reactive aggregate, when tested in accordance with ASTM C 1293 and categorized in accordance with ASTM C 1778, based on alkali content being calculated in accordance with ACI 301.
- D. Combined aggregate gradation for slabs and other designated concrete shall be 8%-18% for large, top size aggregates (1-1/2 inch) or 8%-22% for smaller, top size aggregates (1 inch or 3/4 inch) retained on each sieve size below top size and above No. 100.
- E. Water: ASTM C 94 and potable, clean and free from oil, acid, alkali, organic or other deleterious substances and complying with ASTM C94.

2.7 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260 as indicated in Article "Concrete Mixtures for Building Elements".
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use admixtures containing intentionally-added chlorides.
 1. Water-Reducing Admixture: ASTM C 494, Type A.
 2. Retarding Admixture: ASTM C 494, Type B.
 3. Accelerating Admixture: ASTM C 494, Type C
 4. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 5. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
 6. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 7. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
 8. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
- C. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
 1. Products:
 - a. Axim Concrete Technologies; Catexol 1000CI.
 - b. Cortec Corporation; MCI 2005NS.
 - c. GCP Applied Technologies Inc. (formerly Grace Construction Products); DCI-S.
 - d. BASF Construction Systems.; MasterLife CI 222.
 - e. Sika Corporation; FerroGard-901.

- D. Shrinkage Reducing Admixture
 - 1. Eclipse; GCP Applied Technologies Inc. (formerly Grace Construction Products)
 - 2. MasterLife SRA 20; BASF Construction Systems
 - 3. Mix Water Conditioner; Apply Concrete Technology
 - 4. Catexol 2000 SCA; Axim Concrete Technologies, Inc.
 - 5. PMA-SRA; ProMix Admixtures

2.8 VAPOR BARRIER AND ACCESSORIES

- A. Vapor Barrier:
 - 1. Plastic Vapor Barrier
 - a. Water Vapor Barrier: ASTM E-1745; meets or exceeds Class A.
 - b. Permeance Rating: ASTM E-96 or ASTM F 1249; 0.01 Perms or less.
 - c. Thickness of Barrier: ACI 302.2R-06; not less than 15 mils.
 - 2. Products:
 - a. Stego Wrap (15 mil) Vapor Barrier; Stego Industries
 - b. VaporBlock 15/VaporBlock G; Raven Industries
 - c. Perminator (15 mil); W.R. Meadows
 - d. Viper Vaporcheck II (15 mil); Insulation Solutions Inc.
 - e. Barrier-Bac VB-35 16 mil; Interplast
 - f. Husky Yellow Guard (15 mil); Poly-America
 - g. Tex-Trude Xtreme Vapor Barrier (15 mil); Tex-Trude, LP
- B. Vapor Barrier Accessories
 - 1. Seam/Transition Tape: Tape with pressure sensitive adhesive or double-sided adhesive. Minimum width 4 inches.
 - 2. Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instruction.
- C. Drainage Fill (Coarse):
 - 1. Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel ASTM D 448; coarse-aggregate grading size 57; with 100 percent passing a 1 inch sieve and not more than 5 percent passing a No. 8 sieve.

2.9 CURING MATERIALS

- A. Evaporation Reducer: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Products:
 - a. Spray-Film; ChemMasters.
 - b. AquaFilm; Dayton Superior Corporation.
 - c. Eucobar; Euclid Chemical Company (The).
 - d. Vapor Aid; Kaufman Products, Inc..
 - e. Lambco Skin; Lambert Corporation.
 - f. E-Con; Laticrete International, Inc..
 - g. MasterKure ER 50; BASF Construction Systems.
 - h. Evapre; Meadows, W. R., Inc..
 - i. Waterhold; Metalcrete Industries.
 - j. Monofilm; Nox-Crete Products Group, Kinsman Corporation.
 - k. SikaFilm; Sika Corporation, Inc..
 - l. Certi-Vex EnvioSet; Vexcon Chemicals, Inc..
 - m. TK-2120 TRI-FILM; TK Products, Division of Sierra Corp..
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
 - 1. Color:
 - a. Ambient Temperature below 50 deg. F.: Black.
 - b. Ambient Temperature between 50 deg F. and 85 deg F.: Any color or clear.
 - c. Ambient Temperature above 85 deg F.: White.

- D. Curing Paper: Eight feet wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.
 - 1. Basis-of-Design: Fortifiber Building Systems Group.
- E. Water: Potable.

2.10 SEALERS

- A. Penetrating Anti-Spalling Sealer (Exterior ramps, steps, and stoops): Sealer shall be a siloxane-based compound or silane modified siloxane emulsion formulated to reduce chloride ion absorption/intrusion by 80 percent when tested in accordance with NCHRP #244, Test Method Series II tests. In addition, sealer-treated concrete shall exhibit no scaling when exposed to 125 cycles of freezing and thawing when tested in accordance with ASTM C 672. Tests shall be by an independent testing laboratory.
 - 1. Products:
 - a. Baracade ME (VOC Compliant); Euclid Chemical Co.
 - b. Saltguard WB; PROSOCO, Inc.
 - c. Aquapel Plus; L & M Construction Chemical Co.
 - d. SpallGuard WB-10; ChemMasters
 - e. Sikagard 701W; Sika Corporation
 - f. Weather Worker J29; Dayton Superior Corporation
 - g. Intraguard/Pentreat 244-40; W.R. Meadows
 - h. V-Seal 102 Winter Guard; V-Seal Concrete Sealers and Concrete Coatings.
- B. Floor Sealer: ASTM C1315, Type I, Class A and ASTM C309, Type I, Class A and B. Acrylic water-based urethane clear sealer, non yellowing, resistant to blush, and satin finish as recommended by manufacturer for preventing staining by waterborne and oil substances.
 - 1. Products:
 - a. Everclear VOX (Acrylic Sealer); Euclid Chemical Co.
 - b. MasterKure CC 250 SB; BASF Construction Systems
 - c. Cure and Seal 1315 EF; Dayton Superior
 - d. Polyseal WB; ChemMasters

2.11 RELATED MATERIALS

- A. Expansion and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, ASTM D 1752, cork or self-expanding cork, or ASTM 4819, Type II, or ASTM D 1622 closed-cell compressible foam, 1/4 inch maximum thickness.
- B. Expansion Board Caps: High impact polystyrene caps for fiber board joint filler, designed to be removed after concrete has hardened and before sealants are applied.
- C. Bonding Agent: ASTM C 1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- G. Floor Slab Protective Covering: Eight feet with cellulose fabric.
 - 1. Basis-of-Design: McTech Group, Inc. or a comparable product as recommended by a specialty concrete finish manufacturer.

2.12 REPAIR MATERIALS

- A. Epoxy Crack Injection Adhesive (Repair): ASTM C881, Type I, Grade 1, solvent free.
1. Products:
 - a. Sikadur 35 Hi-Mod LV; Sika Corp.
 - b. Sure-Inject J56; Dayton Superior Corp.
 - c. EUCO #452 LV; Euclid Chemical Co.
 - d. MasterInject 1500; BASF Construction Systems.
 - e. Pro-Poxy 100; Unitex
- B. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.
 5. Products:
 - a. Ardex K-15; Ardex Inc.
 - b. Econolevel; Dayton Superior Corporation.
 - c. Skimflow ES; Dependable Chemical Co., Inc.
 - d. EZ Level; TEC Specialty Products.
 - e. Super FLO TOP; Euclid Chemical Co.
 - f. Levelex; L & M Construction Chemical.
- C. Repair Overlayment (Traffic-Bearing): Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.
 5. Products:
 - a. Level Topping; Dayton Superior
 - b. Duracrete; L & M Construction
 - c. Wearflow; Dependable Chemical Co. Inc.
 - d. Ardex SD-T or K500; Arden Americas.
- D. Patching Material:
1. Use to repair honeycombed, damaged, and other defective concrete.
 - a. Products:
 - 1) Five Star Structural Concrete; Five Star Products, Inc.
 - 2) MasterEmaco S477 CI; BASF Construction Systems
 - 3) Civil/Structural V/O; Dayton Superior Corporation
 2. Use to repair vertical or overhead surfaces
 - a. Products
 - 1) Five Star Structural Concrete V/O; Five Star Products, Inc.
 - 2) MasterEmaco S488 CI; BASF Construction Systems
 - 3) Civil/Structural V/O; Dayton Superior Corporation
 3. Where patching material is being placed in thicknesses greater than 2", it may be extended with pea gravel aggregate in accordance with the manufacturer's recommendations.

2.13 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 20 percent, unless otherwise noted.
 - a. Limit fly ash to 10 percent of special finished concrete where color is applied.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing and accelerating admixture when required by low temperatures or cold-weather placement conditions.
 - 4. Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 - 5. Use corrosion-inhibiting admixture in concrete mixtures, where indicated.
 - 6. Use shrinkage reducing admixture in concrete mixtures, where indicated.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Class A Concrete: Use as a non-excavatable fill material underneath building foundations or where an inexpensive low strength concrete is required.
 - 1. Compressive strength at 28 days: 3000 psi.
 - 2. Minimum cement content: 423 lb/cu yd.
 - 3. Maximum water-cement ratio: 0.58.
 - 4. Air content: 5 to 7% where concrete will be exposed to exterior conditions.
 - 5. Water-reducing admixture required
 - 6. Slump: 6 to 9 inches
- B. Class B Concrete: Use for building foundations, grade beams, curbs, and interior and exterior equipment bases.
 - 1. Compressive strength at 28 days: 4000 psi.
 - 2. Minimum cement content: 517 lb/cu yd.
 - 3. Maximum water-cement ratio: 0.48.
 - 4. Air content: 5 to 7% where concrete will be exposed to exterior conditions.
 - 5. Water-reducing admixture required.
 - 6. Slump: 5 to 8 inches
- C. Class C Concrete: Use where concrete mix class is not otherwise indicated
 - 1. Compressive strength at 28 days: 4000 psi.
 - 2. Minimum cement content: 564 lb/cu yd.
 - 3. Maximum water-cement ratio: 0.40.
 - 4. Air content: 5 to 7% where concrete is exposed to exterior conditions. Limit air content for trowel finished floors to 3%.
 - 5. Water-reducing admixture required.
 - 6. Slump: 5 to 8 inches
- D. Class D Concrete: Use for interior slabs on grade.
 - 1. Compressive strength at 28 days: 3500 psi.
 - 2. Minimum cement content: 470 lb/cu yd. (use 20% fly ash).
 - 3. Maximum water-cement ratio: 0.45.
 - 4. Air content: None added.

5. Water-reducing admixture required.
 6. Substitute pea gravel coarse aggregate only for concrete used to fill metal pan stair system stair treads and landings.
 7. Slump: 5 to 8 inches
- E. Class S Concrete: Use for exterior slabs on grade, stoops, sidewalks, curbs, and drives.
1. Compressive strength at 28 days: 4000 psi.
 2. Minimum cement content: 564 lb/cu yd.
 3. Maximum water-cement ratio: 0.45.
 4. Air content: 5 to 7%
 5. Water-reducing admixture required.
 6. Coarse Aggregate: Crushed limestone
 7. Slump: 5 to 8 inches, less than 2 inches for slip formed curbs.

2.15 PROPORTIONING AND DESIGN OF MIXES

- A. Proportion mixes by either laboratory trial batch or field experience methods as specified in ACI 301, using materials to be employed on project for each class of concrete required.
- B. Submit written reports to A/E of each proposed mix for each type of concrete at least 15 days prior to start of Work. Indicate with each mix design items or structures for which it is to be used. Do not begin concrete production until mixes have been reviewed by A/E. Submit following information:
1. Complete identification of aggregate source of supply.
 2. Tests of aggregates for compliance with specified requirements.
 3. Scale weight of each aggregate.
 4. Absorbed water in each aggregate.
 5. Brand, type, and composition of cement with product information.
 6. Brand, type, and amount of each admixture with product information.
 7. Amounts of water used in trial mixes.
 8. Proportions of each material per cu.yd., including fibrous secondary reinforcement, if used.
 9. Gross weight and yield per cu.yd. of trial mixtures.
 10. Measured slump, with and without water reducer, if used.
 11. Measured air content.
 12. Submit compressive strength results from tests performed by an independent testing agency on at least 30 consecutive strength tests or two groups of tests totaling at least 30 within past 12 months. Supply standard deviation and average strength in accordance with Article 3.9 of ACI 301.
 13. Identification number or name of mix to verify agreement with compression test reports.
 14. Water/Cement Ratio
- C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to Owner and as accepted by A/E. Laboratory test data for revised mix designs and strength results shall be submitted to and must be accepted by A/E before using in work.
- D. Maximum Water Cementitious Ratio: Concrete mixes shall be limited to water-cement ratios specified in Concrete Schedule in these Specifications (Division 03 Section "Concrete Schedule"). Water reducers and fly ash may be used to increase slump while maintaining or reducing water-cementitious ratio at or below maximums specified values, except where specifically prohibited in these specifications.
- E. Concrete Batching: Add color pigments, where indicated, to concrete mix of concrete batch facility at amount recommended by manufacturer for each type of concrete.

2.16 FABRICATING REINFORCEMENT

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

2.17 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
 - 1. Addition of water to batch will be permitted only to regain target slump for particular mix design or with verification that design water/cement ratio has not been exceeded and only under direct control of concrete testing agency field representative. Water shall not be added at the site. All tests on concrete to be performed after water is added.
 - 2. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
 - 3. Mix proprietary materials in accordance with manufacturer's instructions, including product data and product technical bulletins.
 - a. Once specific mix design and sequencing of raw materials have been established, do not alter. Consistency of raw materials in each phase of mixing is the most important element in making quality concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive concrete sealer. Do not apply over curing compounds. Notify A/E if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.2 PREPARATION

- A. Preplacement Observation: Before placing concrete, observe and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other trades to permit installation of their work; cooperate with other trades in setting such work, as required.
 - 1. Observe soil at bottom of foundation systems, which will be subject to testing for soil bearing value by testing laboratory, as directed by A/E. Place concrete immediately after approval of foundation excavations.
 - 2. Observe underslab drainage course areas that were subject to testing for soil bearing value by testing laboratory as required by A/E. Place concrete immediately after approval of underslab compaction tests.
- B. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
 - 1. Access to the work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Security and protection for samples and for testing and inspection equipment at Project site.
- C. Material placement for interior slabs on grade and exterior concrete stoops.
 - 1. Install and properly support and anchor slab welded wire fabric.
 - 2. Position expansion joint fillers where indicated and as recommended by manufacturer. Special precautions shall be taken to avoid collapse during installation.
- D. Under slabs-on-grade, place drainage course on prepared subbase and as follows:
 - 1. Place drainage course on subgrades free of mud, frost, snow, or ice.
 - 2. Compact 6 inch drainage course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
- E. Clean surfaces to receive coatings. Remove loose and foreign matter that could interfere with application or performance of sealer.

3.3 FORMWORK INSTALLATION

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to required shapes, lines, and dimensions.
 - 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 - 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.
 - 3. Side forms are not required at sides of trench footings or footings unless specifically indicated. Contractor responsible for foundations is responsible to verify from Geotechnical Engineering Report included in this Project Manual that soil conditions allow use of earth-formed foundations. If soil conditions do not allow earth-forming, Contractor shall include cost of forming foundations in his bid.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces, where exposed to view.
 - 2. Class C, 1/2 inch for rough-formed finished surfaces, unless otherwise noted.
 - 3. Variation from plumb in lines and surfaces of columns, piers, walls, and arrises; 1/4 inch per 10 feet, but not more than 1 inch. For exposed corner columns, control joint grooves, and other conspicuous lines, 1/4 inch in a bay or 20 feet maximum; 1/2 inch maximum in 40 ft. or more.
 - 4. Variation in sizes and locations of sleeves, floor openings, and wall openings, 1/4 inch.
 - 5. Variations in footings plan dimensions, minus 1/2 inch and plus 2 inches; misplacement or eccentricity, 2 percent of footing width in direction of misplacement but not more than 2 inches; thickness reduction, minus 5 percent.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and like, for easy removal.
 - 4. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete, unless otherwise noted.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of A/E prior to forming openings not indicated on Drawings.

- J. Construction and Movement Joints
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 - a. Where joints divide footings and walls, joints shall have keyway formed. Keyways shall be 1/3 of thickness of element, shall extend to within 3 inches of ends of element and shall be at least 1-1/2 inch thick, unless otherwise noted.
 - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by A/E.
 - 3. Place joints perpendicular to main reinforcement.
- K. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
 - 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 - 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- L. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- M. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- N. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- O. Earth Forming: Where footings are to be constructed in cohesive soils, Contractor may elect to earth form footings with approval of A/E and geotechnical engineer. Earth forms shall be excavated to create vertical faces to detailed dimensions within a tolerance of plus 6 inches, minus 0 inch.

3.4 EMBEDDED ITEMS INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's 303 "Code of Standard Practice for Steel Buildings and Bridges."
 - 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 4. Install dovetail anchor slots in concrete structures as indicated.
 - a. Cast in continuous dovetail anchor slots on vertical concrete surfaces where masonry abuts; 24 inches on center for parallel surfaces and at centerline of masonry for perpendicular walls.
 - 5. Conduits and pipes of aluminum shall not be embedded in structural concrete unless effectively coated to prevent aluminum-concrete reaction or electrolytic action between aluminum and concrete.
 - 6. Pipe and tube railing sleeves and anchors
 - a. Tolerances for spacing shall be $\pm 3/8$ inch, alignment $\pm 1/4$ inch, and plumbness $\pm 1/8$ inch of inserts or field drilled holes.
 - b. Cover holes to keep out debris and water subject to freezing.
 - c. Coordinate post locations with embedded items prior to casting concrete. Shift and adjust rebar as necessary.
 - 7. Clean embedded items immediate prior to concrete placement.

3.5 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place a minimum of 14 days and not until concrete has achieved its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in Work.
 - 1. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces.
 - 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
 - 1. Align and secure joints to avoid offsets.
 - 2. Do not use patched forms for exposed concrete surfaces unless approved by A/E.

3.6 SHORING AND RESHORING INSTALLATION

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.7 VAPOR BARRIER INSTALLATION

- A. Vapor Barriers: Place, protect, and repair vapor barriers according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Place vapor barrier directly below slab and above drainage fill.
 - a. Install vapor barrier material with largest dimension parallel with direction of pour.
 - b. Face laps away from expected direction of concrete pour whenever possible.
 - 2. Extend vapor barrier over footings and seal to foundation wall, grade beam, or slab at an elevation consistent with top of slab or terminate at impediments such as water stops or dowels. Seal around penetrations such as utilities and columns in order to create a monolithic membrane between surface of slab and moisture sources below slab as well as at slab perimeter.
 - a. Seal top edge with continuous bead of high-grade mildew resistant silicone sealant or manufacturer's tape.
 - 3. Lap joints minimum 6 inches, or as instructed by manufacturer, and seal laps in accordance with manufacturer's recommendations.
 - 4. Seal all penetrations (including pipes) with manufacturer's pipe boot or manufacturer's instructions.
 - 5. Extend vapor barrier over tops of footings and grade beams to a distance acceptable to structural engineer and terminate as recommended by manufacturer.
 - 6. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged areas 6 inches and sealing all four sides with tape.

3.8 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.
 - 2. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- B. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4, only where indicated.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of largest aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous and all vertical bars shall be lapped as indicated, placing bars in contact, and tightly tying wire.
 - 2. Stagger splices in accordance with ACI 318.
- G. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging.
 - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice".
 - 2. Lap edges and ends of adjoining sheets at least one mesh spacing plus 2 inches for plain wire and 8 inches for deformed wire.
 - 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 - 4. Lace overlaps with wire.
- H. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.
- I. Provide sufficient numbers of supports and of strength to support reinforcement in correct position. Do not place reinforcing bars more than 2 inches beyond last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
- J. Reinforcing steel installed in continuous footings shall run continuous. This shall include specially shaped components with proper lap where corner reinforcing and step footings occur.
- K. Provide additional reinforcing around required openings in footings and slabs having a one foot least dimension.
- L. Support welded wire fabric in slabs-on-grade with precast concrete bricks at 2 feet spacing in both directions.

3.9 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete. Place joints at ends of pours and where placement operations are stopped for more than 1/2 hour, except where such pours terminate at expansion joints.

- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by A/E.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 3. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Control (Contraction) Joints in Slabs-on-Grade: Form weakened-plane control (contraction) joints, sectioning concrete into areas as indicated. Construct control (contraction) joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form control (contraction) joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control (contraction) joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form control (contraction) joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades with a triangular arbor configuration. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random control (contraction) cracks.
 - a. For most concrete mixtures, this means sawing should be completed within first six to 18 hours and never delayed more than 24 hours. Early-entry saws are available which may allow cutting to begin within a few hours after placement.
 3. Control (contraction) joints shall be filled with self-leveling traffic grade sealant as specified in Division 07 Section "Joint Sealants" for following locations, unless otherwise noted:
 - a. Exposed and concealed concrete slabs on grade with no additional floor finish or sealed concrete finish only.
 - 1) Sealant color shall match sealed concrete color.
 - b. Concrete slabs on grade to receive wood floor system or Contractor may omit joints in slabs under wood flooring.
 4. Locate control (contraction) joints in slabs-on-ground, as indicated, if not shown, then so as to divide slab into sections with a maximum distance of 12 feet between control joints both directions, unless otherwise noted.
 - a. For areas receiving a polished concrete finish decrease spacing of contraction joints to 10 foot each way.
 - 1) Area of contraction joints should be as close to square as possible and shall not exceed a 2:1 aspect ratio.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.10 CONCRETE PLACEMENT

- A. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete". First day test pours shall be a maximum of 1000 sq.ft. total size to work out problems and to determine if adjustments are required to attain proper quality of work. Slab pours shall be limited to not greater than 18 feet in width.

- B. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
 - 1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 - 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as work progresses.
- C. Notify A/E and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- D. Do not add water to concrete during delivery, at Project site, or during placement.
 - 1. Do not add water to concrete after adding water-reducing admixtures to mixture.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - a. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
 - 3. Concrete shall be completely discharged within 1-1/2 hours after entering conveying drum.
 - 4. Pumping methods using steel or plastic pipelines will be permitted. Aluminum alloy lines shall not be used. Minimum pipe diameter allowed for pumping shall be 3 inches.
 - 5. Pumped Concrete: Comply with ACI 304R.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Do not place concrete floors and slabs in a checkerboard sequence.
 - 2. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 3. Maintain reinforcement in position on chairs during concrete placement.
 - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 5. Level concrete, cut high areas, and fill low areas.
 - 6. Slope surfaces uniformly to drains where required.
 - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on surface. Do not further disturb slab surfaces before starting finishing operations.
 - 8. Do not further disturb slab surfaces before starting finishing operations.

3.11 FINISHING FORMED SURFACES

- A. Rough-Formed Finish (SF-1.0): ACI 301 surface finish as-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
 - a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
 - b. Remove projections larger than 1 inch.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 Class D.

- B. Smooth-Formed Finish (SF-2.0): ACI 301 surface finish as-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
 - 2. Remove projections larger than 1/4 inch.
 - 3. Patch holes.
 - 4. Surface Tolerance: ACI 117 Class B.
 - 5. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, and to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply following to smooth-formed finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish (Ab-Fn): Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
 - a. If sufficient cement paste cannot be drawn from concrete by rubbing process, use a grout made from same cementitious materials used in in-place concrete.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.12 FINISHING FLOOR AND SLABS

- A. General Information (Slabs-on-Grade): Requirements indicated are based upon latest FF/FL method. Bids for this work shall reflect these requirements and enforcement can be expected.
 - 1. Comply with ACI 302.1R recommendations for screeding, restraighening and finishing operations for concrete surfaces. Do not wet concrete surfaces.
 - a. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Finished surface is to be free of trowel marks, uniform in texture and appearance and with surface leveled to tolerances indicated. Do not burnish trowel surface.
 - b. Elevated slabs shall comply with following floor flatness (FF) values.
 - 2. Finish surfaces to the following tolerances, in accordance with ASTM E 1155.
- B. Float Finish (Flt-Fn) – Noncritical Floors: When bleed water sheen has disappeared and concrete has stiffened sufficiently to permit operation of specific float apparatus, consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening, until surface is left with uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
 - 1. Specified Overall Value: FF 20/FL 15.
 - 2. Minimum Local Value: FF 14/FL 10.
 - 3. Apply float finish to monolithic slab surfaces that are to receive a trowel finish.
- C. Trowel Finish; General: After applying float finish, apply first troweling and consolidate concrete by hard or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor covering. Do not add water to concrete surface.
 - 1. Trowel Finish 1 (Tr-Fn1): Carpeted Floors, unless otherwise noted.
 - a. Specified Overall Value: FF 25/FL 20.
 - b. Minimum Local Value: FF 17/FL 14.
 - c. Apply trowel finish to monolithic slab surfaces that are to receive carpet and noncritical floors where slabs remain exposed, such as mechanical rooms, unless otherwise noted.
 - 2. Trowel Finish 2 (Tr-Fn2): Floors with improved flatness/levelness requirements.
 - a. Specified Overall Value: FF 35/FL 25.
 - b. Minimum Local Value: FF 24/FL 17.

- c. Apply trowel finish to monolithic slab surfaces that are to receive thin-set flooring, resilient flooring, linoleum flooring, fluid-applied flooring, resinous flooring and other flooring types, unless otherwise indicated.
 - 1) At thin-set tile with all edges shorter than 15 inches, maximum allowable variation shall be 1/4 inch in 10 feet from required plane, with no more than 1/16 inch variation in 1 foot when measured from high points of surface. After surface is steel troweled, apply a fine broom finish.
 - 2) At thin set tile with at least one edge 15 inches in length or longer, maximum allowable variation in substrate is 1/8 inch in 10 feet from required plane, with no more than 1/16 inch variation in 2 feet when measured from high points of surface. After surface is steel troweled, apply a fine broom finish.
- 3. Exposed Surfaces: Use steel-reinforced plastic power trowel blades (in lieu of steel) to control dark burnish marks on plain concrete or surface to receive: stain, dye, shake-on, integral pigments, polished, or clear sealed.
- D. Nonslip Broom Finish (NsBrm-Fn): Apply nonslip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom, perpendicular to main traffic route. Coordinate required final finish with A/E before application.

3.13 MISCELLANEOUS CONCRETE ITEMS INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - 2. Construct concrete base a minimum of 4-inches high unless otherwise indicated; and extend base not less than 6 inches in each direction beyond maximum dimensions of supported equipment unless otherwise indicated.
 - 3. Minimum Compressive Strength: 4,000 psi at 28 days, unless otherwise indicated.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete substrate.
 - 6. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions and directions finished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.14 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 301 and ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

- C. Curing Formed Surfaces: Comply with ACI 308.1 as follows:
 - 1. Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces.
 - 2. If forms remain during curing period, moist cure after loosening forms.
 - 3. If removing forms before end of curing period, continue curing for remainder of curing period as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheetting Materials: Cover exposed concrete surfaces with sheetting material, taping, or lapping seams.

- D. Curing Unformed Surfaces: Cure concrete according to ACI 308.1, by one or a combination of following methods:
 - 1. Begin curing immediately after finishing concrete.
 - 2. Interior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12-inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, following:
 - a) Water.
 - b) Continuous water-fog spray.
 - b. Floors to Receive Urethane Flooring:
 - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - 2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
 - 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
 - 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

3.15 TOLERANCES

- A. Conform to ACI 117.

3.16 SEALER INSTALLATION

- A. Anti-Spalling Sealer: All exterior slabs, unless otherwise noted, shall be sealed with specified penetrating anti-spalling sealer. Surface preparation of slabs and sealer application shall be in strict accordance with directions of manufacturer. Field service shall be provided, upon 5 days' notice, by manufacturer of sealer to assist contractor in obtaining maximum benefits of product under prevailing jobsite conditions. In addition, sealer representative shall attend pre-installation conference with A/E and contractor to discuss proper equipment and procedures.

- B. Floor Sealing Coat: Apply to all exposed slabs that received curing and sealing compounds before turning over building to Owner.
 - 1. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions, including slab preparation requirements. .
 - 2. Application. Apply at a uniform coverage with an individual handheld pump-up or airless sprayer, or by roller. Common garden-type sprayers should not be used. If applying by roller, use a short 3/8-inch nap, solvent resistant roller cover. First coat acts as a primer for second coat. Allow first coat to dry tack-free before applying second coat.
 - a. Follow manufacturer's prescribed coverage rates.
 - 3. Apply second coat near completion of project after final cleaning.

3.17 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month.
 - 2. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Fill control joints with self-leveling traffic grade sealant at following locations:
 - 1. Exposed slabs with no additional floor finish.
 - 2. Slabs to receive wood floor system.

3.18 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by A/E. Remove and replace concrete that cannot be repaired and patched to A/E's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins, and other projections on surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by A/E.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - a. Treat nonmoving substrate cracks to prevent cracks from telegraphing (reflecting) through underlayment according to manufacturer's written recommendations.
 - b. Concrete Substrates: Mechanically remove laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond according to manufacturer's written instructions.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to A/E's approval, using epoxy adhesive and patching mortar.
1. Fill all cracks larger than 1/64 inch in both slabs-on-grade and elevated slabs with epoxy crack injection adhesive.
- F. Repair materials and installation not specified above may be used, subject to A/E's approval.

3.19 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added to Project site.
- C. Inspections: Refer to end of this Section.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 6. Compression Test Specimens: ASTM C 31.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure for first 24-hours two sets of two standard cylinder specimens for each composite sample.
 7. Compressive-Strength Tests: ASTM C 39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 10. Test results shall be reported in writing to A/E, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 11. Nondestructive Testing: Rebound hammer, sonoscope, or other nondestructive device may be permitted by A/E but will not be used as sole basis for approval or rejection of concrete.
 12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by A/E. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by A/E.
 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 14. Correct deficiencies in Work that test reports and inspections indicate do not comply with Contract Documents.
- E. Contractor shall measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

3.20 CONCRETE WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess concrete materials are Contractor's property. At completion of work, remove from Project site.
- B. Excess Concrete Waste: Remove excess clean concrete waste and other concreting operations waste, and legally dispose of off Owner's property.

3.21 PROTECTION

- A. General, protect concrete surfaces as follows:
 1. Protect from petroleum stains.
 2. Diaper hydraulic equipment used over concrete surfaces.

3. Prohibit vehicles from interior concrete slabs.
 4. Prohibit use of pipe-cutting machinery over unprotected concrete surfaces.
 5. Prohibit placement of steel items directly on concrete surfaces.
 6. Prohibit use of acids or acidic detergents over concrete surfaces.
- B. Protect concrete that will remain exposed and has or will receive a floor or slab treatment or a curing and sealing compound with protective cover.
- C. Slab Protection: Where concrete surface is scheduled to receive special concrete finish or remain exposed.
1. Floor must be protected from following:
 - a. Silicone chalks should not be used if at all possible. Red and yellow chalks are permanent dyes. Red chalks, black markers, wax pencils should not be used for framing. White or blue chalks are ok. Do not over mark for framing. Do not use silicone sprays to hold lines. Sprays repel stain and leave harsh, permanent scars on floor.
 - b. Do not use, tape, glue, solvents, pine-sol, varnish, non-breathing plastics, liquid nail, silicone, plastics, nails, plumbers glue, foam insulation, bond release agents, flux, oils, grease, polyurethane, paint, markers (framers often write dimensions of doorways in marker on slab. They need to make notes on framing instead), grease sticks, spray paints, crayons, muriatic acid, and other chemicals both before and after staining. Do not allow to spill or sit on floor.
It is important that wood, sheet goods, insulation boards, plywood, press board, drywall, sections of framing and like not lay on slab for extended periods of time. They can transfer resins and tannins into slab. This will alter moisture content in slab which leaves a pattern in finished floor. Cardboard should be placed between slab and stacked material to minimize any unwanted transfer. Also food, beverages, oil, glass, metal, paint, chalk, or primers. Be sure to check lift tires for nails and screws, diaper all equipment from oil and grease drips, don't allow pipe cutting equipment on slab without protection.

3.22 REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

VERIFICATION AND INSPECTION	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD	IBC REFERENCE
1. Inspection of reinforcement, including prestressing tendons, and verify placement.	---	X	ACI 318: 3.5, 7.1-7.7	1910.4
2. Inspection of anchors cast-in-concrete where allowable loads have been increased or where strength design is used.	---	X	ACI 318:8.1.3, 21.1.8 AISC 360: N7	1908.5 1909.1
3. Inspection of anchors post-installed in hardened concrete members. (See Note 2)		X	ACI 318:3.8.6, 8.1.3, 21.1.8	1909.1
4. Verifying use of required design mix.	--	X	ACI 318: Ch.4, 5.2-5.4	1904.2, 1910.2, 1910.3
5. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	--	ASTM C172, C31 ACI 318.5.6, 5.8	1910.10
6. Inspection of concrete and shotcrete placement for proper application techniques.	X	---	ACI 318: 5.9, 5.10	1910.6, 1910.7, 1910.8
7. Inspection for maintenance of specified curing temperature and techniques.	--	X	ACI 318: 5.11-5.13	1910.9
8. Inspect formwork for shape, location and dimensions of the concrete member being formed.	---	X	ACI 318:6.1.1	---

Notes:

- Where applicable, see IBC Section 1705.11, Special Inspections for Seismic Resistance
- Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with ACI 355.2 or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

END OF SECTION 03 30 00

04

DIVISION

MASONRY

SECTION 04 20 00.00 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
 - 1. Concrete masonry units (CMUs).
 - 2. Clay face brick.
 - 3. Mortar and grout.
 - 4. Masonry joint reinforcement.
 - 5. Ties and anchors.
 - 6. Embedded flashing.
 - 7. Miscellaneous masonry accessories.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for dovetail slots for masonry anchors.
 - 2. Division 07 Section "Fluid-Applied Air and Vapor Barrier" for fluid-applied membrane air barrier, vapor permeable.
 - 3. Division 07 Section "Sheet Metal Flashing and Trim" for formed reglets and for additional requirements for solder and sealant for sheet metal flashing.
 - 4. Division 07 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.
 - 5. Division 09 Sections "Tiling" and "Resilient Base and Accessories" for coordination of bullnosed CMU with height of wall base.
- C. Products installed, but not furnished, under this Section include the following:
 - 1. Steel lintels and shelf angles for unit masonry, furnished under Division 05 Section "Metal Fabrications".
 - 2. Products furnished under Division 05 Section "Metal Fabrications", including post installed anchors.
 - 3. Nailing blocks furnished under Division 06 Section "Rough Carpentry".
 - 4. Hollow metal frames will be provided under Division 08 Section "Hollow Metal Doors and Frames".
 - 5. Conduits and plumbing will be provided under Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning, Division 26 – Electrical, Division 27 – Communications, and Division 28 – Electronic Safety and Security.

1.2 REFERENCES

- A. Definitions
 - 1. General: Definitions, glossary and terminology used in this Section are from the National Concrete Masonry Association TEK 01-04.
 - 2. CMU(s): Concrete Masonry Units.
 - 3. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.
 - 4. Cavity: A continuous air space between wythes of masonry or between masonry and its backup system.
 - 5. Cavity Mortar Protection: Used in conjunction with flashing and weep vents to provide a system to properly evacuate moisture from a masonry cavity wall by providing a continuous path for incidental moisture to escape from weep vents.
 - 6. Cavity Wall: A multiwythe non-composite masonry wall with a continuous air space within the wall (with or without insulation), which is tied together with metal ties.
 - 7. Composite Wall: A multiwythe wall where the individual masonry wythes act together to resist applied loads. Transfer of stress between components of a member designed so that in resisting loads, the combined components act together as a single member.
 - 8. Wall, Loadbearing: Wall that supports vertical load in addition to its own weight. By code, a wall carrying vertical loads greater than 200 lb./ft. in addition to its own weights.

9. Wall, Multiwythe: Wall composed of 2 or more masonry wythes.
10. Wythe: Each continuous vertical section of a wall, one masonry unit in thickness.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate installation of masonry and masonry accessories with thermal and air barrier and other moisture protection work to provide a tested wall assembly.
- B. Pre-installation Meeting: Conduct meeting at Project site. Note: As work progresses, additional pre-installation meetings might need to take place to coordinate installation of various components of exterior enclosure.
 1. Meet with Owner, A/E, CM, testing and inspection agency representative, mason, and other installers whose work interfaces with or affect masonry.
 2. Review methods and procedures related to masonry installation, including manufacturers' requirements and recommendations.
 3. Review temporary protection requirements.
 4. Review mockup and cleaning requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including but not limited to:
 1. Flexible flashing materials, including manufacturer's written installation instructions.
- B. Samples for Verification: For each type and color of the following:
 1. Provide samples at the project site only.
 2. Face brick, in the form of straps of five or more bricks.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
 1. Masonry units.
 - a. Provide material test reports substantiating compliance with requirements, if requested.
 - b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include material test report for efflorescence according to ASTM C 67, and the following:
 - 1) Compressive strength
 - 2) 24 hour cold water absorption
 - 3) 5 hour boil absorption
 - 4) Saturation coefficient
 - 5) Initial rate of absorption (suction)
 - d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing according to ASTM C 67 and a list of address of buildings in Project's area where proposed bricks has been used successfully and with a history of durability.
 2. CMU: Upon regular presentation within past 12 months of representative units by approved manufacturer, a test report from an independent laboratory showing resultant weight, compressive strength (based on net area), and water absorption properties, as well as adherence to standards where so specified, for:
 - a. Each proposed type and size of concrete masonry units.
 - b. Test reports shall conform to ASTM C140 and shall include:
 - 1) Name of Manufacturer
 - 2) Date of Manufacture of Test Specimen
 - 3) Dimension Measurements (in.)
 - 4) Calculated Gross Area (sq.in.)
 - 5) Calculated Net Area (sq.in.)

- 6) Total Load (lbs.)
 - 7) Net Unit Load (psi)
 - 8) Sample Weight (lbs.)
 - 9) Dry Weight (lbs.)
 - 10) Wet Weight (lbs.)
 - 11) Immersed Weight (lbs.)
 - 12) Density (pcf)
 - 13) Moisture Content (%)
 - 14) Absorption (%)
 - 15) Linear Shrinkage Coefficient (%)
- a. CMU: Submit compression test results from an independent testing laboratory showing the compressive strength of each type and size of concrete masonry units delivered to the construction site during the first fifteen days of masonry construction. Submit additional tests from each type and size of concrete masonry units for each 10,000 sq.ft. of concrete masonry wall constructed. The independent testing laboratory is to select units to be tested from materials stockpiled on the Project site.
 4. Cementitious materials. Include brand, type, and name of manufacturer.
 5. Mortar admixtures.
 6. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 7. Grout mixes. Include description of type and proportions of ingredients.
 8. Reinforcing bars.
 9. Joint reinforcement.
 10. Anchors, ties, and metal accessories.
 11. Flexible Flashing. Certification of compatibility by manufacturer, listing all materials on the Project with which the product and accessories may come into contact.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
 2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement. For both fine and course grouts including complete identities and proportions of ingredients.
 - a. Weight of each ingredient including water.
 - b. Measured slump.
 - c. Water/cement ratio.
 - d. Sieve analysis for aggregates.
- C. 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 according to Tables 1 and 2 in TMS 402/602.

1.6 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Do not proceed with work prior to receipt of written acceptance of mock-up by A/E. Observation and evaluation of the mockup shall be by A/E, CM, General Trades Contractor and Masonry Contractor.
1. Build mockups for typical exterior wall(s) in sizes approximately 72 inches long by 60 inches high full and by full thickness, including face and backup wythes and accessories.
 - a. General, exterior wall mockup shall be constructed to verify wall performance. Mockup shall demonstrate how components will integrate into the assembly and exhibit how the thermal and air barrier transition to various components, for example, wall transition to roof. Coordinate mockup with testing requirements of Air Barrier.

- b. Use step-back construction to expose the relationship of various wall components to each other. Components incorporated and exposed for observation shall include examples of:
 - 1) Facing units;
 - 2) Weeps, vents, cavity drainage material, and other accessories; including clean out ports;
 - 3) Mortar of the correct color(s) and strength(s);
 - 4) Backup wall construction;
 - a) Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup; with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - 5) Joint reinforcing;
 - 6) Structural reinforcing, grouting, and accessories;
 - 7) Ties and anchors;
 - 8) Cavity insulation, air barriers and/or vapor retarders;
 - 9) Shelf angles and their supports;
 - 10) Bond beams and lintels;
 - 11) Flashings (including terminations, plane changes, and end dams); and
 - a) Include air barrier veneer anchors, flashing, cavity mortar protection, and weep vents in exterior masonry-veneer wall mockup, where applicable.
 - 12) Masonry expansion and control joints
 - 13) Include at least one switch or outlet box. If surface mounted items, such as exterior lighting, audio horns, or video cameras, will be installed in split-faced masonry, provide at least one example installation.
 - c. Include a sealant-filled joint at least 16 inches long in each exterior wall mockup.
 - d. Mockups shall include typical parapet/eave detail, transitions from wall to roof/roof to wall (flashing, thermal and air barrier transition details), and include the following typical wall penetrations:
 - 1) Entries/doors.
 - 2) Openings, i.e. storefront, curtainwall, and windows.
 - a) First in place of each type opening installed shall leave portions of the perimeter exposed for inspection of fasteners and air barrier transitions. Some portions of mockup shall receive final sealant so it can be tested for air barrier compliance.
 - b) Demonstrate blocking at openings, movement joints (sealant filled) minimum 1 to 4 inches.
 - 3) Roof to wall transitions, including pitched roof to high wall transitions when applicable.
 - 4) Include an example of thru-wall penetration by each trade contractor including fire protection, plumbing, mechanical and electrical.
 - e. The mockup shall be photographed or recorded on video by the masonry contractor to be part of a presentation for groups of trade's people as they join project work force.
- 2. The mockup need not be fully constructed at one time, but construction and approval of each element shall precede the construction of its respective exterior wall components. The mockup shall mirror the building development starting with the foundation and ending at the top of the wall and its transition to the roof. Reviews will be scheduled around the weekly progress meetings. If required attendees are not present, then that phase will be delayed and rescheduled. Respective mockup phase shall be completed and approved before that portion of work starts at the building. Anticipated phasing:
 - a. Phase One: Install the CMU backup wythe per the approved mockup drawing. The CMU backup wythe shall include rebar, centering clips, ladder reinforcing, grout, bond beam, and bearing plates.

- b. Phase Two: Install the embedded flashing in the presence of A/E, CM, General Trades Contractor and Masonry Contractor flashing manufacturer, and Owner's Testing and Inspection Agency. Embedded flashing shall include the flashing, all sealants and adhesives, termination bar, fasteners, end dams, and inside and outside corners.
 - 1) Pre-Installation Meeting for masonry veneer will be held on this date.
 - 2) Flashing will be reviewed and will require approval by all present.
 - c. Phase Three: Review the exterior face of the CMU backup wythe prior to the installation of the air barrier / spray insulation. Install the air barrier / spray insulation in the presence of A/E, CM, and Owner.
 - 1) Pre-Installation Meeting for air barrier / spray insulation will be held on this date.
 - 2) Air barrier / spray insulation will be reviewed and will require approval by all present.
 - d. Phase Four: Install the masonry veneer per the approved mockup drawing.
 - 1) Masonry veneer will be reviewed and will require approval by A/E, CM, and Owner.
 - e. Phase Five: Clean the mockup veneer.
 - 1) Pre-Installation Meeting for cleaning of masonry veneer will be held on this date.
 - 2) Cleaning of mockup veneer will be reviewed and will require approval by A/E, CM, and Owner.
 - 3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
 - 4. Prior to starting general masonry cleaning, prepare mock-up for cleaning using the same cleaning materials and methods proposed for the Work, and under same weather conditions to be expected during cleaning. Obtain A/E's acceptance of visual qualities before proceeding with masonry restoration. Record cleaning process and results of all testing.
 - a. Test materials and methods on samples of adjacent non-masonry materials for possible reaction with cleaning materials, except where materials and methods are known to have a deleterious effect on such materials.
 - b. Allow a waiting period of the duration indicated, but not less than 7 calendar days, after completion of sample cleaning to permit a study of sample panels for negative reactions.
 - 5. Protect accepted mockups from the elements with weather-resistant membrane.
 - 6. 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. Panel shall be used as a standard of comparison for all masonry work built of same material.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by A/E in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by A/E in writing.
 - 7. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Assume responsibility for acceptance of masonry units delivered to Project site being in compliance with specified ASTM requirements for chippage and dimensional tolerances.
 - 1. Inspect decorative units upon delivery to ensure color match with required materials and accepted mock-up panel.

- B. Store masonry units on elevated platforms in a dry location to prevent contamination by mud, dust or materials likely to cause staining or other defects. 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.
 - 1. Cover masonry units at all times.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
 - 1. Deliver cementitious and other packaged materials in unopened containers, plainly marked and labeled with manufacturers' names and brands.
 - 2. Handle cementitious materials in a manner that will prevent the inclusion of foreign materials and damage by water or dampness.
- D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
 - 1. Stockpile and handle aggregates to prevent contamination from foreign materials. Store different aggregates separately.
 - 2. Store sand on tarps to keep ground water from wicking into sand.
- E. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.
 - 1. Deliver flexible flashing materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
 - 2. Store flexible flashing materials as recommended by manufacturer. Keep away from open flame or sources of ignition.
 - 3. Protect insulation from physical damage. Handle boards carefully so corners are not broken off or boards otherwise damaged.

1.8 FIELD CONDITIONS

- A. Refer to Division 01 Section "Product Requirements".
 - 1. Do not apply flexible flashing on wet or damp surfaces.
 - 2. Apply flashing to surfaces free of dirt, oils, lubricants, and other debris.
 - 3. Install flexible flashing materials at temperature above 40 deg. F. At temperature below 40 deg. F., apply primer in accordance with flashing manufacturer's recommendations, prior to installation of flashing.
 - 4. Do not use metal reinforcements or ties coated with loose rust or other coatings, including ice, which will reduce bond.
- B. 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. Refer to Section 1.8B ("Masonry Protection") in TMS 402/602. Note: Protection is required by Building Code.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 - 2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
 - 3. Continue to cover walls until tie-in to roof is complete and top of wall is protected from water penetration.

- C. This structure is designed to be self-supporting and stable after the building is fully completed. Protect masonry walls against wind damage by bracing as required until support of walls is integral with the completed building structure. This includes the addition of whatever temporary bracing, guys, or tie-downs that might be necessary. Such material is not shown on the Drawings. If applied, they shall be removed as conditions permit, and shall remain the Contractor's property.
1. Safety: It is solely the Contractor's responsibility to follow all applicable safety codes and regulations governing this Work.
 2. Load application after building masonry columns, piers, or walls
 - a. Do not apply uniform design floor or roof loading for at least 12 hours.
 - b. Do not apply concentrated loads for at least 3 days.
- D. 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.
- E. 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 NCMA TEK 03-01C. Comply with cold-weather construction requirements contained in TMS 402/602 with special emphasis on the following:
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
 - a. To assure mortar temperatures between 40 degrees F and 120 degrees F until used, heat mixing water or aggregates when air temperature is between 32 degrees F and 40 degrees F. When the air temperature is between 25 degrees F and 32 degrees F, heat both water and aggregate.
 - b. Do not heat water or sand above 160 degrees F.
 2. Comply with the requirements of the governing code and with the "Construction and Protection Recommendations for Cold Weather Masonry Construction" of the Technical Notes of Brick and Tile Construction by the Brick Industry Association (BIA) and International Masonry Industry All-Weather Council, "Recommended Practices and Guide Specifications for Cold Weather Masonry Construction."
- F. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602 and the following:
1. Masonry construction performed when ambient temperature exceeds 100 degrees F (or 90 degrees F with wind velocities greater than 8 mph) shall conform to the following requirements:
 - a. Store materials in cool, shaded location.
 - b. Cover aggregate stockpiles with black plastic sheet to retard the evaporation of moisture.
 - c. Cool reinforcing steel, metal accessories, wheelbarrows, mixers and mortar boards by flushing with water.
 - d. Wet high-suction brick.
 - e. Increase lime and/or cement content to maximum allowed under ASTM C270 for mortar type specified.
 - f. Increase water content of mortar and grout as needed.
 - g. Spread mortar beds no more than 4 feet ahead of masonry, and set units within one minute of spreading mortar.
 - h. Moist cure masonry by water fog spray after tooled joints have set.

- i. Cover walls to retard evaporation.
- j. Schedule work to avoid hottest part of day.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany request for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate. Do not change source or brands of masonry mortar materials during the course of the Work.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops indicated net-area compressive strengths (f'_m) at 28 days.
 - 1. Determine net-area compressive strength (f'_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in TMS 402/602.
- B. Regulatory Requirements: Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified:
 - 1. TMS 402/602 "Building Code Requirements and Specification for Masonry Structures."
 - a. Maintain one copy of the standard in project field office at all times during construction. Contractor's supervisory personnel shall be thoroughly familiar with this material as it applies to the project and shall be present at all times and direct work performed under this Section.
 - 2. National Concrete Masonry Association (NCMA)
 - a. NCMA TEK Bulletin 03-01C "All Weather Concrete Masonry Construction".
 - b. NCMA TEK Bulletin 03-02A "Grouting Concrete Masonry Walls".
 - c. NCMA TEK Bulletin 03-08A "Concrete Masonry Construction".
 - d. NCMA TEK Bulletin 03-04C "Bracing Concrete Masonry Walls Under Construction".
 - e. NCMA TEK Bulletin 05-02A "Clay and Concrete Masonry Banding Details".
 - f. NCMA TEK Bulletin 07-01D "Fire Resistance Rating of Concrete Masonry Assemblies".
 - g. NCMA TEK Bulletin 08-02A "Removal of Stains from Concrete Masonry".
 - h. NCMA TEK Bulletin 08-03A "Control and Removal of Efflorescence".
 - i. NCMA TEK Bulletin 08-04A "Cleaning Concrete Masonry".
 - j. NCMA TEK Bulletin 09-01A "Mortars for Concrete Masonry".
 - k. NCMA TEK Bulletin 10-01A "Crack Control in Concrete Masonry Walls".

- l. NCMA TEK Bulletin 10-02D "Control Joints for Concrete Masonry Walls – Empirical Method".
 - m. NCMA TEK Bulletin 10-03 "Control Joints for Concrete Masonry Walls – Alternative Engineering Method.
 - n. NCMA TEK Bulletin 10-04 "Crack Control for Concrete Brick and Other Concrete Masonry Veneers".
 - o. NCMA TEK Bulletin 12-04D "Steel Reinforcement for Concrete Masonry".
 - p. NCMA TEK Bulletin 14-04B "Strength Design Provisions for Concrete Masonry."
 - q. NCMA TEK Bulletin 14-07C "Allowable Stress Design of Concrete Masonry (2012 IBC & 2011 MSJC)."
 - r. NCMA TEK Bulletin 19-04A "Flashing Strategies for Concrete Masonry Walls".
 - s. NCMA TEK Bulletin 19-05A "Flashing Details for Concrete Masonry Walls."
 - t. NCMA TEK Bulletin 19-07 "Characteristics of Concrete Masonry Units with Integral Water Repellent".
3. ASTM International:
 - a. ASTM C33 "Standard Specification for Concrete Aggregates."
 - b. ASTM C90 "Standard Specification for Loadbearing Concrete Masonry Units."
 - c. ASTM C91 "Masonry Cement."
 - d. ASTM C140 "Standard Test Methods of Sampling and Testing Concrete Masonry Units."
 - e. ASTM C144 "Standard Specification for Aggregate for Masonry Mortar."
 - f. ASTM C150 "Standard Specification for Portland Cement."
 - g. ASTM C207 "Standard Specification for Hydrated Lime for Masonry Purposes."
 - h. ASTM C270 "Standard Specification for Mortar of Unit Masonry."
 - i. ASTM C426 "Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units."
 - j. ASTM C 476 "Standard Specification for Grout for Masonry".
 - k. ASTM C780 "Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry."
 - l. ASTM C979 "Standard Specification for Pigments for Integrally Colored Concrete."
 - m. ASTM E514 "Standard Test Method for Water Penetration and Leakage Through Masonry".
 4. International Masonry Industry All-Weather Council (IMIABC).
 - a. "Recommended Practices and Guide Specifications for Cold Weather Masonry Construction – 1993".
 5. International Masonry Institute
 - a. "Internal Bracing Design Guide for Masonry Walls Under Construction".
 - b. Detailing Series.
 6. Underwriters' Laboratory Inc. (UL)
 - a. UL "Building Materials Directory".
 - b. UL 618 "Standard for Concrete Masonry".
 7. Brick Industry Association (BIA)
 - a. BIA Technical Notes No. 1 – Revised 1992: All weather construction.
 - b. BIA M1-88: Specifications for Portland Cement Lime Mortar for Brick Masonry.
 - c. BIA Technical Notes No. 7 – Water Penetration Resistance – Design and Detail.
 - d. BIA Technical Notes No. 18A – Accommodating Expansion of Brickwork.
 - e. BIA Technical Notes No. 20 – Revised 1990: Cleaning Brick Masonry.
 - f. BIA Technical Notes No. 27 – Revised 1994: Brick Masonry Rain Screen Walls.
 - g. BIA Technical Notes No. 28B – Revised 1987: Brick Veneer.
 - h. BIA Technical Notes No. 28C – Thin Brick Veneer.

2.3 MASONRY UNITS, GENERAL

- A. Masonry Standard: Comply with ACI/ASCE 6/TMS 602, unless modified by requirements in the Contract Documents.

- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.
- C. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS (CMUs)

- A. Shapes: Provide shapes indicated and as follows:
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide bullnose units for outside corners and at sills, unless otherwise indicated or sill is indicated to receive additional finish materials.
 - a. At base of wall and where indicated (first CMU course above floor), provide exposed square edge external corners. Above base transition square edge to the bullnose above by grinding.
 - b. Provide bullnose unit with 1 inch radius bullnose (BN1), unless otherwise noted.
 - c. Provide double bullnose units 1 inch radius bullnose (BN2) at top of half wall as indicated.
 - 3. Provide two core type masonry units where required to receive vertical reinforcing.
 - 4. Bond beam units shall be such that where two reinforcing steel bars are required in the bond beams, bars may be located not greater than 2-5/8 inch from both faces of the unit. Bond beam units that do not allow the two bars to be separated and to be within 2 5/8" of each face will not be acceptable.
- B. Concrete Masonry Units: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2,800 psi.
 - 2. Weight Classification: Normal weight.
 - 3. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

2.5 BRICK

- A. General: Provide shapes indicated and as follows:
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 - 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 - 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Clay Face Brick: ASTM C 216, Grade SW, Type FBX or FBS.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi.
 - 2. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - 3. Modular: Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

4. Application: Use where brick is exposed, unless otherwise indicated.
 - a. Provide solid units and units with finish on multiple sides as required by configurations.
5. Products: Refer to manufacturer and color noted on Drawings.
 - a. Brick Color A: Belden Brick – No. 8632 Medium.
 - b. Brick Color B: Belden Brick – No 8532.
 - c. Texture: Velour

2.6 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color(s) indicated.
 1. Alkali content shall not be more than 0.6 percent when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 270, Type S.
- D. Masonry Cement: ASTM C 91 veneer only.
 1. Products:
 - a. Brixment or Velvet; Essroc, Italcementi Group.
Mortamix Masonry Cement or Rainbow Mortamix Custom Buff Masonry Cement or White Mortamix Masonry Cement; Holcim (US) Inc.
 - b. Magnolia Masonry Cement or Lafarge Masonry Cement or Trinity White Masonry Type S or Trinity White Masonry Type N; Lafarge North America Inc.
 - c. Lehigh Masonry Cement or Lehigh White Masonry Cement; Lehigh Cement Company
 - d. Richmortar; CEMEX.
 - e. Miami Masonry Cement; Fairborn Cement Company.
- E. Mortar Cement: ASTM C 1329.
- F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
 1. Products:
 - a. Bayferrox Iron Oxide Pigments; Bayer Corporation, Industrial Chemicals Div.
 - b. True Tone Mortar Colors; Davis Colors.
 - c. MasterColor; Master Builders Solutions.
 - d. SGS Mortar Colors; Solomon Grind-Chem Services, Inc.
 - e. Prism Pigments, a Division of Mix Manufacturing, Inc.
 - f. Euclid Chemical Company.
 - g. Lanxess Corp.
 - h. Acme-Hardesty Co., Acme-Shield Plus Admixture; Cargill.
- G. Colored Cement Product: Packaged blend made from Portland cement and lime, masonry cement, or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 1. Products:
 - a. Colored Portland Cement-Lime Mix:
 - 1) Rainbow Mortamix Custom Color Cement/Lime; Holcim (US) Inc.
 - 2) Eaglebond; Lafarge North America Inc.
 - 3) Lehigh Custom Color Portland/Lime Cement; Lehigh Cement Company.
 - 4) Color Mortar Blend; Glen-Gery Corp.
 - 5) Salyor's PLUS; Essroc.
 - 6) PCL; CEMEX.

- b. Colored Masonry Cement:
 - 1) Flamingo-Brixment; Essroc, Italcementi Group.
 - 2) Rainbow Mortamix Custom Color Masonry Cement; Holcim (US) Inc.
 - 3) Magnolia Masonry Cement; Lafarge North America Inc.
 - 4) Lehigh Custom Color Masonry Cement; Lehigh Cement Company.
 - 5) Coosa Masonry Cement; National Cement Company, Inc.
 - 6) Richcolor Masonry Cement; CEMEX.
 - 7) Miamicolor Masonry Cement; Fairborn Cement Company.
 - 2. Formulate blend as required to produce color(s) indicated or, if not indicated, as selected from manufacturer's standard colors.
 - 3. Pigments shall not exceed 10 percent of Portland cement by weight.
 - 4. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
 - H. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color(s), where required for mix design.
 - I. Aggregate for Grout: ASTM C 404.
 - 1. Fine Aggregates: ASTM C404, clean, sharp, natural sand free from loam, clay lumps, or other deleterious substances.
 - 2. Coarse Aggregates: ASTM C404, clean, uncoated, pea gravel containing no clay, mud, loam, or foreign matter. Maximum aggregate size 3/4 inch.
 - J. Admixtures, General:
 - 1. No air-entraining admixtures or material containing air-entraining admixtures.
 - 2. No antifreeze compounds shall be added to mortar.
 - 3. No admixtures containing chlorides shall be added to mortar.
 - K. Cold-Weather Admixture: Non-chloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, ASTM C 1384, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 1. Products:
 - a. Accelguard 80; Euclid Chemical Company.
 - b. Morset; GCP Applied Technologies.
 - c. MasterSet AC 534 or MasterSet FP 20; Master Builders Solutions.
 - L. Water: Conform to ASTM C1602 for mixing water.

2.7 REINFORCEMENT

- A. Masonry Joint Reinforcement, General: ASTM A 951 and as follows:
 - 1. Provide welded wire units prefabricated in straight lengths of not less than 10 foot, with matching corner ("L") and intersection ("T") units.
 - 2. Fabricate from cold-drawn steel wire complying with ASTM A82, with deformed or embossed continuous side rods and plain cross-rods, with unit width of 1-1/2 to 2 inches less than thickness of wall or partition.
 - 3. Wire shall be galvanized in accordance with the following:
 - a. Joint reinforcement, interior walls or exposed to relative humidity less than or equal to 75 percent
 - 1) ASTM A641, mill galvanized (0.10 oz. per sq.ft.)
 - b. Wire ties or anchors in interior walls or exposed to relative humidity less than or equal to 75 percent
 - 1) ASTM A641 (0.35 oz. per sq.ft.)

- c. Joint reinforcement, wire ties, or anchors in exterior walls or a mean relative humidity exceeding 75 percent
 - 1) ASTM A153, Class B (1.50 oz. per sq.ft.)
- d. Sheet metal ties or anchors, interior walls or exposed to relative humidity less than or equal to 75 percent
 - 1) ASTM A653, G60 (0.60 oz. per sq.ft.)
- e. Sheet metal ties or anchors in exterior walls or a mean relative humidity exceeding 75 percent
 - 1) ASTM A153, Class B (1.50 oz. per sq.ft.)
- f. Steel plates and bars
 - 1) ASTM A153, Class B
- 4. For foundation walls consisting of two wythes of CMU, provide ladder type joint reinforcing fabricated with four W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods. Joint reinforcing shall be placed in every CMU joint or no more than 8 inches o.c. Side rods shall align with face shells of CMU.
- 5. For single wythe foundation walls, provide ladder type joint reinforcing fabricated with two W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods. Joint reinforcing shall be placed in every CMU joint or no more than 8 inches o.c.
- 6. For joint reinforcing in walls, other than those described above, refer to Drawings for particular requirements.
- 7. All ladder type joint reinforcing shall have cross rods spaced at 16 inches o.c.
- 8. All ladder type joint reinforcing shall be lapped 6 inches minimum.
- 9. All ladder type joint reinforcing shall be discontinuous across movement joints.

2.8 TIES AND ANCHORS

- A. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
 - 1. Ensure components and materials are compatible with specified accessories and adjacent materials.
- B. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.
 - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 1064; with ASTM A 641, Class 1 coating, provide in interior walls where humidity is less than 75 percent.
 - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 1064; with ASTM A 153, Class B-2 coating, unless otherwise noted.
 - 3. Galvanized Steel Sheet: ASTM A 653, Commercial Steel, G60 (Z180) zinc coating, provide in interior walls where humidity is less than 75 percent.
 - 4. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153, unless otherwise noted.
 - 5. Steel Plates, Shapes, and Bars: ASTM A 36.
 - 6. Stainless Steel bars: ASTM A 276 or ASTM A 666, Type 304.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
 - 1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
 - 2. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
 - 3. Wire: Fabricate from 3/16-inch diameter, hot-dip galvanized steel wire. Mill-galvanized wire ties may be used in interior walls, except in spaces where relative humidity can be expected to exceed 75-percent relative humidity (showers, locker rooms) or where otherwise indicated.

- D. Adjustable Masonry-Veneer Anchors: Provide screw-attached, masonry-veneer anchors with separate horizontal reinforcing .
1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch.
 - b. Anchor shall meet or exceed requirements for air leakage and water penetration established for Project.
 2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - a. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch thick, steel sheet, galvanized after fabrication.
 - b. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch diameter, hot-dip galvanized steel wire.
 - c. Products:
 - 1) 315-D with 316 or Pos-I-Tie or 213-2X; Heckmann Building Products Inc.
 - 2) HB-213 with 2X Hook or Adjusto-Tie; Hohmann & Barnard, Inc.
 - 3) 1004, Type III or RJ-711; Wire-Bond.
 - 4) Thermal-Grip Masonry Veneer Anchor Pos-i-tie: TRUFAST Walls
 3. Anchor Section: Corrosion-resistant, self-drilling, eye-screw designed to receive wire tie. Eye-screw has spacer that seats directly against framing and is same thickness as sheathing and has gasketed, washer head or tape to protect hole in sheathing.
 - a. Products
 - 1) Pos-I-Tie; Heckmann Building Products.
 - 2) SureTie; Wire Bond.
 - 3) X-Seal Anchor or 2 Seal Tie Veneer Anchor; Hohmann and Barnard.
 - 4) Thermal Grip MVA or Pos-i-tie: TRUFAST Walls.

2.9 MISCELLANEOUS ANCHORS

- A. Stabilization Anchors: Provide where masonry walls intersect concrete or existing masonry walls. Bonds masonry walls and restrains lateral movement while allowing expansion and control joints to perform as designed.
1. Products:
 - a. Slip Set Stabilizer; Hohmann & Barnard, Inc.
 - b. 1700; Wire-Bond.
- B. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of dimensions indicated.

2.10 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
1. Reglets/Receivers: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with mitered and welded corners and junctions. Formed reglets must comply with requirements of Division 07 Section "Sheet Metal Flashing and Trim".
 - a. Materials, provide one of the following:
 - 1) Stainless Steel: 0.0187 inch thick (fka 26 gauge).
 - b. Masonry Type: Provide extension leg to extend to face of inner CMU wythe (or sheathing with a veneer wall configuration) with an off-set top flange.
 2. Metal Terminations for Flexible Flashing: Fabricate from 26 or 28 gauge stainless steel. Extend into wall as indicated (but not less than 3 inches) and out to exterior face of wall. At exterior face of wall, bend metal down at an angle and back on itself for 3/4 inch to form a drip edge.

- a. Provide a bead of elastomeric silicone sealant between lintel and drip edge to prevent water from wicking back onto lintel.
 - b. Provide hemmed edge turning back 180 degrees to be flush with face of veneer at base of wall only.
 - c. Provide extend stainless steel termination as indicated on Drawings at base of masonry wall condition.
 3. Stainless steel end dams may also be used in conjunction with flexible flashing.
- B. Flexible Flashing: For flashing not exposed to the exterior, coordinate with air barrier system and use the following, unless otherwise indicated:
 1. Provide one of the following:
 - a. York 304 SA Self-Adhered, Stainless Steel; York Manufacturing, Inc.
 - b. Gorilla Flash SS Peel and Stick Butyl; STS Coatings, Inc.
 - c. IPCO Self-Adhesive Stainless Steel; Illinois Products, Inc.
 - d. TK Self-Adhering Stainless Steel TWF; TK Products, Inc.
 - e. Mighty-Flash-SA; Hohmann and Barnard Inc.
 - f. Bond-N-Flash S.A.; Wire Bond
 2. Characteristics/Properties
 - a. Type: Stainless steel core with one stainless steel face with a butyl block co-polymer adhesive.
 - b. Stainless steel type: 304, ASTM A 167.
 - c. Adhesive: Block co-polymer.
 - d. Size: Manufacturer's standard width rolls.
 - e. Performance attributes
 - 1) Tensile strength, > 90,000 psi
 - 2) Puncture resistance, > 2,500 pounds average
 - 3) When tested as manufactured, product resists growth of mold pursuant to test method ASTM D 3273.
 3. Accessories: Products shall be as recommended by flashing manufacturer
 - a. Polyether Sealant
 - 1) UniverSeal US-100; York Manufacturing, Inc.
 - 2) GreatSeal LT-100; STS Coatings, Inc.
 - 3) R-Guard Joint Seam Sealer; Prosoco, Inc.
 - 4) HB Sealant; Hohmann and Barnard Inc.
 - 5) Quick Set Sealant; Wire Bond
 - b. Splice Tape/Transition Flashing (Self Adhered)
 - 1) York 304SS; York Manufacturing, Inc.
 - 2) IPCO Self-Adhering Stainless Steel Flashing; Illinois Products, Inc.
 - 3) X-Seal Splice Tape; Hohmann and Barnard Inc.
 - 4) Anchorseal Tape; Wire Bond
 - c. Corner and End Dams: Use only 26 gauge stainless steel pre-manufactured corners.
 - d. Water-Based Primer: Provide when recommended by manufacturer for application indicated.
 - 1) Primer-SA; Hohmann and Barnard Inc.
 - 2) Aqua Flash Primer; Wire Bond
- C. Solder and Sealants for Sheet Metal Flashings: As specified in Division 07 Section "Sheet Metal Flashing and Trim."
 1. Solder for Stainless Steel: ASTM B 32, Grade Sn96, with acid flux of type recommended by stainless-steel sheet manufacturer.
 2. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight. Sealant shall be approved by flexible flashing manufacturer for use with flashing.
- D. Adhesives, Mastic, Sealant, 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. Cavity Bridge: Stainless steel fabrication, Type 304 grade, 26 gauge. Provide pre-drilled holes as required for anchors to substrate
 - 1. Size and Configuration as indicated on Drawings.
- F. Termination Bar: 26 gauge, minimum predrilled stainless-steel approximately 1-1/2 inch wide by 8 foot sections, 45 deg. lip at top for sealant, to be used at top of flashing to secure it to backup.
 - 1. Acceptable Manufacturers/Products
 - a. T-2 Termination Bar; Hohmann & Barnard, Inc.
 - b. #4210 Termination Bar; Wire-Bond.
 - c. Stainless Steel Accessories 45; York Flashings.
 - d. Stainless Steel Termination Bar; IPCO.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane.
 - 1. Products:
 - a. Neo-Seal IV 2218-3/Everlastic 1056 Joint Filler; Williams Products, Inc.
 - b. #NS-Closed Cell Neoprene Sponge; Hohmann and Barnard, Inc.
 - c. Neocell; IPCO.
 - d. #NS-Closed Cell; National Construction Materials Corp.
 - e. Sandell's Closed Cell Neoprene; Sandell Construction Solutions.
- B. Thermal Barrier (Break); Unfaced, Mineral-Wool Board Insulation: ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Nominal density of 4.4 lb./cu.ft.
 - 2. Moisture Resistance; ASTM C 1104: Moisture Sorption, 0.03 percent.
 - 3. Thermal Resistance; ASTM C 518: R-value/inch at 75 deg. F., 4.2 hr.ft.². F/Btu.
- C. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- D. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- E. Weep/Vent Products: Use one of the following, unless otherwise indicated:
 - 1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color(s) selected from manufacturer's standard.
 - a. Products:
 - 1) Mortar Maze weep vent; Advanced Building Products Inc.
 - 2) No. 85 Cell Vent; Heckmann Building Products Inc.
 - 3) Quadro-Vent; Hohmann & Barnard, Inc.
 - 4) Cell Vent, 3601; Wire-Bond.
 - 5) Sandell's Cell Vents; Sandell Construction Solutions.
 - 6) Cell Vent; MasonPro.
 - 7) Cell Vent; Mortar Net Solutions.
 - 2. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color(s) selected from manufacturer's standard.
 - 3. Adjustable Weep Vent: IPCO.
 - 4. Stainless Steel Weep/Vent: Type 304 stainless steel.
 - a. York Manufacturing Inc.

- F. Cavity Mortar Protection Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity. Installer shall select product thickness(es) in the field based on observed clear air space between cavity insulation and outer wythe. Clear air space shall not exceed selected product thickness by more than 0.40-inch. Where clear air space exceeds manufacturer's thickest available product by more than 0.40-inch, Installer shall insert a supplemental wythe of extruded polystyrene (XEPS) insulation on inner face, sized to make up the difference.
1. Provide one of the following types:
 - a. Profiled strips, 10-inches high, with dovetail shaped notches 7-inches deep that prevent mesh from being clogged with mortar droppings.
 - b. Rectangular strips, not less than 10-inches high, with or without dimpled surface, designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
 - c. Sheets or rectangular strips installed continuously from flashing to height indicated, to prevent weep holes from being clogged with mortar.
 2. Products:
 - a. Mortar Break; Advanced Building Products Inc.
 - b. CavClear Masonry Mat; Archovations, Inc.
 - c. Mortar Web/Trap; Hohmann & Barnard Inc.
 - d. Mortar Mitt; Sandell.
 - e. Driwal Mortar Deflection/Driwall Masonry Vent System; Keene Building Products.
 - f. Mason ProNet DT; MasonPro.
 - g. Mortar Net; Mortar Net Solutions.
 - h. Weep-Net; York Manufacturing Inc.
 3. Fabric Mesh to Prevent Clogging of Weep Holes (Option): Non-woven polyester fabric used as part of masonry cavity drainage systems with flashing, weep holes or weep vents. Drapes over interior side of weep holes/vents keeping them free of mortar and debris; routes water to flashing and to weeps by draining through body of product.
 - a. Materials: Recycled polyester, free-draining mesh, made from polymer stands that will not degrade within cavity wall.
 - b. Mold Growth Resistance: In compliance with ASTM D 3273 and ASTM G 21.
- G. Grout Sample Box: When approved by the A/E, grout sample box shall be proven by tests to yield comparable compressive strength values to samples cast by traditional methods regardless of CMU moisture content. Box shall perform as a mold and transport/shipping container in one as specified by ASTM C 1019.
1. Basis-of-Design: Deslauriers, Inc.
- H. Column Isolation: Around all steel columns in masonry walls, provide 1/2 inch minimum isolation material to prevent the masonry from coming in contact with the displaced column during loading and to prevent mortar from being within the same joint.
1. Products:
 - a. Ceramar Flexible Foam; W.R. Meadows, Inc.
 - b. Econ-O-Foam; Williams Products.
 - c. Nomaboard; Nomaco Inc.
 - d. Column Backboard; Williams Products.
 - e. Column Wrap; MasonPro.
- I. Grout Stop: Fiberglass, galvanized steel, or polypropylene screen.
1. Products:
 - a. Metal Lath 268; Heckmann Building Products, Inc.
 - b. MGS - Mortar/Grout Screen; Hohmann & Barnard, Inc.
 - c. Grout Stop 3612; Wire-Bond.
 - d. Grout Stop; MasonPro.
- J. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 degrees F (minus 32 degrees C). Provide products with low compression set and of size and shape to provide a seal for compartmentalization.

2.12 MASONRY CLEANERS AND ACCESSORIES

- A. Preformed Expansion Joint Filler: Provide closed cell sponge neoprene expansion joint filler conforming to ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated.
- B. Bituminous Coating: Cold applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold applied asphalt emulsion complying with ASTM D1187, Type II.
- C. Masonry Cleaners: Provide one of the following cleaning products expressly approved for intended use by cleaner manufacturer and manufacturer of unit being cleaned as verified on "mock-up".
 - 1. Job Mixed Detergent Solution: Solution of trisodium phosphate (1/2 cup dry measure) and laundry detergent (1/2 cup dry measure) dissolved in one gallon of water.
 - 2. Proprietary Acidic Cleaner: Manufacturer's standard strength, general purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned. Do not use products containing hydrochloric (muriatic acid, hydrofluoric acid, or ammonium bifluoride).
 - a. For brick masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface acting acids, chelating, and wetting agents.
 - 1) Products:
 - a) Sure Klean No. 600 Detergent; ProSoCo., Inc.
 - b) 202 Detergent; Diedrich Technologies.
 - c) NMD 80 New Masonry Detergent; EaCo Chem, Inc.
 - b. For dark colored brick masonry not subject to metallic oxidation stains, use formulation consisting of a liquid blend of surface acting acids and special inhibitors.
 - 1) Products:
 - a) ProSoCo., Inc.; Sure Klean No. 101 Lime Solvent.
 - b) Diedrich Technologies; 200 Lime Solv.
 - c) EaCo Chem, Inc., NMD 80 New Masonry Detergent.
 - c. For brick masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic acids and special inhibitors.
 - 1) Products:
 - a) Sure Klean Vana Trol; ProSoCo., Inc.
 - b) 202 Vana-Stop; Diedrich Technologies.
 - c) NMD 80 New Masonry Detergent; EaCo Chem, Inc.
 - D. Spray Equipment: Provide equipment for controlled spray application of water and chemical cleaners, if any, at rates indicated or recommended for pressure, measured at spray tip, and for volume. Adjust pressure and volume, as required, to ensure that damage to masonry does not result from cleaning methods.
 - 1. For chemical cleaner spray application, provide a low pressure tank or chemical pump suitable for the chemical cleaner indicated, equipped with a cone-shaped spray tip.
 - 2. For water spray application, provide a fan-shaped spray tip that disperses water at an angle of not less than 15 degrees.

2.13 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. When specifically approved by the A/E, admixtures shall meet ASTM C1384 Standard Specification for Admixtures for Masonry Mortars.
 - 1. Do not use calcium chloride in mortar or grout.

2. Maintain workability of standard grey mortar by remixing or retempering. No mortar shall be used beyond 2-1/2 hours after mixing. Do not retemper colored pigmented mortar because color variations may result.
 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar Batching
1. For each unit volume of cementitious materials, provide 2.25 to 3.5 volumes of aggregates.
 2. In a running mechanical paddle mixer, add 2/3 of the water and 1/2 of the aggregate (sand), then add the cementitious materials. Follow by adding the remaining water. Mix for a minimum of 5 minutes, adding water if required to produce a workable consistency.
 - a. Do not hand mix mortar, unless approved in writing by A/E.
- C. 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.
- D. Mortar for Unit Masonry: Comply with ASTM C 270, Property 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 use Type M, where indicated only.
 2. For masonry, use Type S, unless otherwise noted.
 3. For non-load bearing interior partitions, use Type N or S, unless otherwise noted.
 4. For exterior, above-grade, masonry veneer, use Type N or S, unless otherwise noted.
- E. Use natural (noncolored) mortar for the following:
1. Concrete masonry units, unless otherwise noted.
- F. Colored Pigmented Mortar: Select and proportion pigments with other ingredients to produce color indicated or, if not indicated, as selected from manufacturer's standard formulation to compliment adjacent units.
1. Use colored pigmented mortar for the following locations:
 - a. Clay face brick
 2. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color(s) required. Limit pigments to the following percentages of cement content by weight:
 - a. For mineral oxide pigments and Portland cement lime mortar, not more than 10 percent.
 - b. For carbon black pigment and Portland cement lime mortar, not more than 2 percent.
 - c. For mineral oxide pigments and masonry cement mortar not more than 5 percent.
 - d. For carbon black pigment and masonry cement mortar, not more than 1 percent.
 3. Color: As selected by A/E.
- G. Pointing mortar shall conform to ASTM C270, except that all sand shall pass a No. 16 sieve. Nonstaining and dirt resistant mortar shall be used to which ammonium stearate or calcium stearate is added to the amount equal to 3 percent of the weight of the cement used.
1. Pointing mortar shall be proportioned by volume with one part portland cement, 1/8 part Type S hydrated lime, and 2 parts graded (50 mesh or finer) sand to which ammonium stearate or calcium stearate is added in an amount equal to 2 percent of the weight of the cement used. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.
 2. Add colored mortar pigment to produce mortar colors required. Coordinate with CMU manufacturer to produce color(s) required to match CMU for repair of face.
 3. Use pointing mortar to repair chipped CMU units.

- H. Grout for Unit Masonry (by Strength): Comply with ASTM C 476. Grout mixes shall be designed by strength, unless specifically noted otherwise in the Contract Documents.
1. Conventional Grout
 - a. General: Do not use admixtures, including pigment, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated. Do not lower the freezing point of grout by use of admixtures or anti-freeze agents.
 - 1) Admixtures containing chlorides in excess of 0.2 percent chloride ions are not permitted to be used.
 - 2) Antifreezes are prohibited for use in grouts.
 - 3) Fly ash: ASTM C618-89a, Type C or F may be substituted for up to 20 percent of the total cementitious materials in the grout mix.
 - b. Grout mixes shall be plant mix or factory blended (dry mix with water added at Project site).
 - c. Field mixed grout designs are not acceptable.
 - d. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in TMS 402/602 for dimensions of grout spaces and pour height.
 - e. Provide grout with a slump of 8 to 10 inches as measured according to ASTM C 143.
 2. Self-Consolidating Grout
 - a. Jobsite proportioning of self-consolidating grout is not permitted. Do not add water at jobsite except in accordance with self-consolidating grout manufacturer's instructions.
 - b. Admixtures for Self-Consolidating Grout
 - 1) High-Range Water-Reducing Admixture
 - 2) Viscosity-Modifying Admixture
 - c. Slump Flow: 24 to 30 inches as determined in accordance with ASTM C1611.
 - d. Visual Stability Index (VSI): Less than or equal to 1 as determined in accordance with ASTM C1611, Appendix X.1.
 - e. Consolidation or reconsolidation is not required for self-consolidating grout.

2.14 SOURCE QUALITY CONTROL

- A. Concrete Masonry Inspection
1. Refer to Division 01 Section "Quality Requirements".
 2. Materials may require testing and retesting, as directed by the A/E, during the progress of the Work. Allow free access to material stockpiles, facilities and completed construction.
 3. See structural plans for special inspection requirements for masonry walls.
- B. Verification of Performance: Masonry Contractor shall water test cavity to verify all water is draining to the exterior through the weeps before continuing with exterior wythe and before capping wall.
1. Contractor shall perform initial tests in the presence of A/E, flexible flashing manufacturer, and General Trades Contractor. After successful initial tests have been performed additional testing shall be performed in the presence of them so tests can be witnessed and documented. A/E shall be notified when testing is to occur, in case they too wish to witness the testing, otherwise will submit documentation to A/E as work progresses.
 - a. Testing shall occur at first 200 square feet of masonry wall and include a window opening and opening flashing.
 2. Contractor shall hold water hose and with standard water pressure, force water into the cavity at a cell vent so water can be observed coming out adjacent weeps for a period of at least 5 minutes. Contractor shall continue down the wall to the next cell vent where a weep did not indicate water wicking out and continue this process until the entire length of flashing is tested.
 3. Where water is observed inside the building or outside the building away from the weeps, masonry units shall be removed and flashing reinspected and repaired.
 4. Water test shall be repeated where flashing was repaired.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work in accordance with TMS 402/602, Article 2.1.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify critical steel elevations to ensure flashing will be installed at proper locations.
- B. Before installation, examine rough-in and built-in construction for piping systems or conduit to verify actual locations of connections.
 - 1. Do not install anything in the cavity space of the exterior wall that:
 - a. Diminishes the designed R-Value of the cavity-wall insulation.
 - b. Encroaches on the required air gap.
- C. Verify substrate and surface conditions are in accordance with flexible flashing manufacturer recommended tolerances prior to installation.
 - 1. Review requirements for sequencing of installation of flexible flashing assembly with installation of windows, doors, louvers and wall penetrations to provide a weathertight flashing assembly.
 - 2. Verify flexible flashing will be continuously supported by substrate, and not span any gaps or voids in excess of 1/2 inch.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General
 - 1. If ice or snow has formed on masonry bed, remove by carefully applying heat until top surface is dry to the touch.
 - 2. Remove all masonry deemed frozen or damaged.
- B. Protect concrete floor from damage where floor will remain exposed.
- C. Concrete Surfaces: Where masonry is to be placed, clean concrete of laitance, dust, dirt, oil, organic matter, or other foreign materials that would inhibit bond of mortar to the surface.

3.3 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.
 - 1. Note: In lieu of double wythe foundation walls, single wythe matching nominal overall width of double wythe may be provided.
- B. Build chases and recesses to accommodate items specified in this and other Sections. Provide not less than 8 inches of masonry between chases or recesses and jamb of openings, and between adjacent chases and recesses.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
 - 1. Consult other trades and make provisions to permit installation of their work in a manner to avoid cutting and patching. Build in work specified under other Sections, as necessary, and as work progresses.

- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.
- F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
 - 1. When units are above 32 deg. F, heat water above 70 deg. F.
 - 2. When units are below 32 deg. F, heat water above 130 deg F.
 - 3. Recommended procedure to ensure that brick are nearly saturated, surface dry when laid is to place a hose on the pile of brick until the water runs from the pile. This should be done one day before brick are to be used. In extremely warm weather, place hose on pile several hours before brick are to be used.
- G. Do not wet concrete masonry units.
- H. Cleaning Reinforcement: Before being placed, remove loose rust, ice, or other coatings from reinforcement.

3.4 TOLERANCES

- A. General: Comply with construction tolerances in TMS 402/602 and the following:
- B. Dimensions and Locations of Elements:
 - 1. For dimension in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
 - 4. If the above condition, cannot be meet due to previous construction, notify the A/E.
- C. Lines and Levels
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet or 1/2 inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2 inch maximum.
 - 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
- D. Joints
 - 1. Unless additional restrictions are indicated, horizontal mortar joints between masonry units shall be in the range of: 1/4 inch to 1/2 inch.
 - 2. Vertical mortar joints between masonry units shall be in the range of: 1/8 inch to 3/4 inch.

3. For brick bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
 4. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 5. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
 6. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
 7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.
- E. Reinforcing Bars: Tolerances for placing reinforcing bars are:
1. Variation from d for flexural elements (measured from center of reinforcement to the extreme compressive face of masonry):
 - a. $d \leq 8$ inch $\pm 1/2$ inch
 - b. $8 \text{ inch} < d \leq 24$ inch ± 1 inch
 - c. $d > 24$ inch $\pm 1-1/4$ inch
 2. For vertical bars in walls 2 inch from the location along the length of the wall indicated on the project drawings.
 3. In addition, a minimum clear distance between reinforcing bars and the adjacent face of a masonry unit of 1/4 inch for fine grout or 1/2 inch for coarse grout must be maintained so that grout can flow around the bars.

3.5 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
1. Do not install cracked, broken, or chipped masonry units exceeding ASTM allowances.
 2. Clean units of surface dirt and contaminants before placing in contact with mortar.
 3. Lay-up walls plumb and true and with courses level, accurately spaced, within specified tolerances, and coordinated with other work. Do not wedge partitions tight against structural ceiling or beams, but provide an acoustical joint between masonry and the structural roof deck, structural steel framing or structural floor deck at nonrated conditions. Refer to Division 07 Section "Acoustical Joint Sealants". At rated walls, provide firestopping. Refer to Division 07 Section "Fire-Resistive Joint Systems."
 - a. Cut masonry as required to maintain 2 inches clearance between masonry and all steel or reinforced concrete structural members that pass through or above walls, but are not to be supported by the walls.
- B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.
1. One-half running bond with vertical joint in each course centered on units in courses above and below, unless otherwise noted.
 2. Provide special bonding as indicated on Drawings.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
1. Align unit cells or cores that are to be grouted.
- D. Stopping and Resuming Work: Stop work at vertical control joints or by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
1. Stop off horizontal run of masonry by racking back 1/2 length of unit in each course.
 2. Tothing is not permitted, except upon written acceptance of the A/E.

- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
1. Install adjustable hollow metal frame anchors, locating anchors on jambs in horizontal bed courses near the top and bottom of each frame and at intermediate points not over 24 inches apart.
 2. Unless otherwise noted or thermal break is required, contractor may grout jambs of hollow metal door and window frames in accordance with ANSI 250.8.
 - a. Where grout is installed during masonry installation, frames shall be braced or fastened in such a way that will prevent the pressure of the grout from deforming the frame members. Grout shall be mixed to provide a 4 inch maximum slump consistency, hand troweled into place. Grout mixed to a thin "pumpable" consistency shall not be used.
 3. Rake joints around exterior side of exterior hollow metal door frames for sealant under Division 7.
 4. Protect inside (concealed) faces of door frames in exterior masonry walls, using fibered asphalt emulsion coating. Apply over shop primer approximately 1/8 inch thick and allow to dry before handling.
 5. Where hollow metal frames do not wrap around masonry jambs and heads, rub exposed corners of block to remove sharp, irregular edges.
 6. Take particular care to embed all conduits and pipes within concrete masonry without fracturing exposed shells and to fit units around switch, receptacle and other boxes set in walls. Where electric conduits, outlets, switch boxes, and similar items occur, grind and cut units before building in services. Prepare cutouts in such a manner that units can be installed plumb and flush.
 7. Install anchors, reglets, and nailers for flashing and related work built into masonry work, where indicated.
- F. Where built-in items are to be embedded in cores of hollow masonry units, place a grout stop (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 concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- H. Where non-loadbearing, full-height masonry walls intersect structural framing above, provide a minimum 1/2 inch clear joint around the member.
1. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Joint Firestopping".

3.6 MORTAR BEDDING AND JOINTING

- A. Mortar Bedding; Brick and Concrete Masonry Units as follows:
1. Mix mortar ingredients for a minimum of 5 minutes in a mechanical batch mixer. Use water clear and free of deleterious materials that would impair the work. Each mortar batch is allowed only one retempering. Do not use mortar, which has begun to set after the first retempering, or if more than 2-1/2 hours has elapsed since initial mixing. Retempering will be permitted only within 1-1/2 hours of mixing, to replace moisture lost by evaporation. Discard any mortar or grout that is partially set.
 2. Lay brick and other solid masonry units with completely filled bed and head joints. Do not deeply furrow bed joints. Butter ends with sufficient mortar to fill head joints and shove into place. Butter ends of brick in hand and in the wall at closures. Do not slush head joints. Rock closures into place with head joints thrown against adjacent brick in place.
 - a. Do not pound corners and jambs to fit stretcher units after they are set in position. Where an adjustment must be made after mortar has started to harden, remove mortar and replace with fresh mortar.
 3. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells; also bed webs in mortar in starting course on footings and foundation walls, in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.

- a. Construct bed joint of the starting course of foundation with a thickness not less than 1/4 inch and not more than 3/4 inch.
 4. Remove mortar protruding into cells or cavities that will be grouted. Do not permit mortar droppings to fall into cells, cavities of multi-wythe walls or to block weep holes. Maintain clear cavity width between facing and backing material and keep clear of mortar droppings by back beveling the mortar bed to prevent excess from extruding into cavity. Clean any excess that does occur by paring it to back of unit.
 5. Fill holes not specified in exposed and below grade masonry with mortar.
- B. Joints: Maintain joint widths shown, except for minor variations required, to maintain bond alignment. Lay walls with 3/8 inch joints. Tool joints consistently with the same type round jointer when the mortar is thumb print hard. Use a jointer that is slightly larger than the joint width so that complete contact is made along the edges of the unit. Tool joints in exposed masonry walls at uniform moisture content to avoid color variations. Perform tooling so that the mortar is compressed and the joint surface is sealed. Cut joints flush for masonry walls that are to be concealed or to be covered by other materials. For exposed masonry, provide joints as follows:
1. Exterior Joints
 - a. Concave tooled, unless otherwise noted.
 - b. Provide tooled joints horizontal and vertical at scored concrete masonry units, including score joint.
 2. Interior (Room Side) Joints
 - a. Concave tooled, unless otherwise noted.
 3. Cavity Wall (Exterior Side of Inner Wythe) Joints: Cut joints flush for masonry walls to receive air barrier.

3.7 MULTI-WYTHE (COMPOSITE) MASONRY, GENERAL

- A. Bond wythes of multiwythe masonry (non-composite) together using one of the following methods:
1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
 - a. Where bed joints of wythes do not align or when wythes are not laid at the same time, use adjustable (two-piece) type ties.
 2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
- B. Corners: Provide interlocking masonry units 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 shown at juncture, bond wall together as follows:
1. Provide continuity with masonry-joint reinforcement by using prefabricated T-shaped units.
 - a. Where indicated, provide individual metal ties not more than 16 inches o.c.
 - b. Where indicated, provide rigid metal anchors not more than 48 inches o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.8 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
 - 1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
 - a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
 - b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.
 - 2. Masonry Joint Reinforcement: Provide unless otherwise noted. Install in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes, if both wythes are concrete masonry and installed simultaneously. At no time shall a wythe be more than 16 inches higher than any other wythe being constructed concurrently.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align. Wythes may be laid up full height separate from facing wythe.
 - 1) Cavity width changes shall be accommodated by different sized wire ties; wire ties should not be bent or deformed to span the cavity space.
 - 3. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- 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.
 - 1. Keep cavity clean of mortar droppings by suspending by wires a wooden strip the width of the air space. Strip shall be lifted as each course of joint reinforcement is laid in facing wythe. Install cavity mortar protection in cavity above through wall flashing and where indicated for additional protection.

- C. Apply air barrier to face of backup wythe to comply with Division 07 "Air Barrier" sections.

3.9 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c., unless otherwise noted.
 - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
 - a. Reinforcement above is in addition to continuous reinforcement.
 - 4. Provide reinforcement in every other course of concrete masonry veneer, but not in the same course as the tie.
- 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 returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

F. ANCHORING MASONRY VENEERS

- G. Anchor masonry veneers to wall framing concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 2. Embed tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and exterior face of inner wythe or sheathing.
 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
 5. Masonry veneer anchors shall be embedded a minimum of 1-1/2 inches into the mortar joint. Provide a minimum of 5/8 inch mortar coverage at veneer to the outside face.
- H. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing or insulation.
1. Keep air space clean of mortar droppings and other materials during construction. Bevel beds away from air space, to minimize mortar protrusions into air space. Do not attempt to trowel or remove mortar fins protruding into air space.

3.10 CONTROL AND EXPANSION JOINTS (MOVEMENT JOINTS)

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Other than bond beams do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
1. Install an elastomeric tubing sealant backer rod at each control joint to compartmentalize masonry cavity.
 2. Reinforcing and grout for masonry bond beams are to run continuous through vertical control joints.
 3. Keep joints clean from all mortar and debris.
- B. Form control joints in concrete masonry using one of the following methods:
1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick made from clay or shale as follows:
1. Build in compressible joint fillers, unless otherwise noted.
- D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.
1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.
- E. Expansion Joint Locations in Brick: Provide in accordance with BIA Technical Note No. 18A at vertical expansion joints in brick masonry at all offsets, returns, openings, intersections with dissimilar materials, and elsewhere as shown on Drawings and indicated hereinafter. For brick work without openings, space no more than 25 feet o.c.

1. Place as follows:
 - a. At or near corners
 - b. At offsets and setbacks
 - c. At wall intersections
 - d. At changes in wall height
 - e. Where wall backing system changes
 - f. Where support of brick veneer changes
 - g. Where wall function or climatic exposure changes
 - h. At one jamb of openings 12 feet or wider.
2. Form open joint of width indicated but not less than 3/8 inch for installation of preformed expansion joint filler, and sealant and backer rod specified in Division 07 Section "Joint Sealants". Maintain joint free and clear of mortar.

F. Building Expansion Joint Through Masonry

1. Form open joint of width indicated but not less than 3/8 inch for installation of preformed expansion joint filler, and sealant and backer rod specified in Division 07 Section "Preformed Joint Seals". Maintain joint free and clear of mortar.
2. For expansion joints 2 inches and greater, refer to Division 07 Section "Expansion Control".

3.11 LINTELS

A. Install loose steel lintels furnished under Division 05.

1. Shore steel lintels until the masonry has attained sufficient strength to carry its own weight. Limit the deflection of masonry during this period to L/600 or 0.3 inch (whichever is less). This shoring period should not be less than 24 hour. This minimum time period should be increased to three days when there are imposed loads to be supported. If the masonry is built in cold weather construction conditions, the length of cure should be increased.

B. For steel lintels in exterior wythe, rake back mortar in preparation for sealant as specified in Division 07 Section "Joint Sealants".

3.12 FLASHING, WEEPS, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep vents in first course of masonry above ground level, at shelf angles, lintels, ledges, above doors, windows and other openings and under coping and sills, other obstructions to downward flow of water in wall. Flashing shall be installed longitudinally continuous or terminated with end dams. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities. Comply with NCMA recommendations for "drainage wall system" masonry construction.

1. Install concealed through wall flashing in accordance with SMACNA "Architectural Sheet Metal Manual" Chapter 4 Flashing and with NCMA TEK Bulletins 19-04A and 19-05A details to ensure water resistant masonry construction.
2. Apply primer, if required by manufacturer according to manufacturer's written instructions.
3. Install preformed corners and end dams, cants, if required, under flexible flashing membrane, bedded in sealant in appropriate locations along wall.
4. Starting at a corner, remove release sheet, if applicable, and apply membrane to primed, if required by manufacturer for substrate indicated.
5. Extend membrane through wall and leave 1/4 inch minimum exposed.
6. Roll flashing into place. Ensure continuous and direct contact with substrate. Avoid trapping air and forming wrinkles.
7. Lap ends and overlap preformed corners 4 inches minimum. Seal all laps with sealant.
8. Trim exterior edge of flexible flashing membrane 3/4 inch and secure to metal drip edge per manufacturers written instructions, where drip edge is required.
 - a. Embedded flashing materials shall not be used for drip edges.
9. Terminate flexible flashing membrane on vertical wall with a termination bar.
10. Apply sealant bead at each termination.

11. Protect installed flexible flashing from damage during construction.
 - a. Inspect before covering and make repairs as necessary. Remove and replace damaged material. Repair holes and tears by covering with cut patch of similar product overlapping damage 2 inches minimum. Seal perimeter of patch repair with sealant/mastic.
 - b. Cover flexible flashing as soon as possible after installation has been observed and tested. Do not expose longer than 60 days, unless otherwise approved by membrane manufacturer in writing.
- 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.
 - a. Install proprietary flashing/drainage system in accordance with manufacturer's installation instructions.
 2. At multiwythe masonry walls, including cavity walls, where wall intersects grade, extend flashing through outer wythe, turn up 16 inches or a minimum of 6 inches above cavity mortar protection, and terminate on exterior face of inner wythe with termination bar and sealant. Cut flexible flashing off flush at face of wall after masonry wall construction in completed.
 3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 16 inches or a minimum of 6 inches above cavity mortar protection, and terminate with a termination bar and sealant. Terminate flashing at outer wythe using the same methods used at multiwythe masonry walls as specified hereinbefore.
 4. At lintels and shelf angles, extend flashing over top flange of angle across air space behind veneer and turn up a 16 inches or a minimum of 6 inches above cavity mortar protection, and terminate on exterior face of inner wythe or sheathing with termination bar and sealant. At outer wythe extend flashing at least 6 inches beyond end of lintel or shelf angle and turn up ends not less than 2 inches to form end dams. Install metal drip edges beneath flexible flashing at exterior face of wall and seal with sealant to lintel or shelf angle. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
 - a. Where the lintel or shelf angle is bolt-mounted in place, cut-off excess bolt length at face of nut prior to installing the flexible flashing. After positioning the flexible flashing, cut a small "X" in the flashing to allow the flashing to fit over the nut and then apply compatible mastic to the flashing a minimum of 1 inch out from the "X" in all directions.
- C. Install weep vents in head joints in exterior wythes of first course of masonry immediately above embedded flashing (not mortar) and as follows:
 1. Use specified weep/vent products to form weeps.
 2. Space weep vents 16 inches o.c., unless otherwise indicated.
 3. Keep weep holes and area above flashing free of mortar droppings.
- D. Place cavity mortar protection material in cavities to comply with configuration requirements for cavity mortar protection material in Part 2 "Miscellaneous Masonry Accessories" Article.
 1. Option: Use geotextile drainage fabric as recommended by flashing manufacturer, and install to have the fabric reach the base of the flashing and covering the weep vents.
 - a. Inspect flashing for holes prior to installing fabric mesh. Coordinate repair of holes with installer of flashing.
 - b. Place a continuous row of fabric mesh one inch into the mortar joint of the third row of standard size exterior bricks in collar joints, cavity walls, or lintels. Drape excess material onto base of flashing. Ensure that flashing is clean of mortar droppings and debris. Adhesives and fasteners are not required; mortar need not have set.

- c. If excessive droppings are expected, use a taller height fabric mesh and taller flashing.
 - d. Cut or tear to accommodate wall ties, conduit, plumbing or other materials that bridge or intrude into cavity between inner and outer walls.
- E. Install vents in head joints in exterior wythes at 32 inches o.c., unless otherwise indicated. Use specified weep/vent products to form vents.
 - 1. Close cavities off vertically with elastomeric tube sealant back rod in manner indicated. Install through-wall flashing and weep vents above horizontal blocking.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage qualified independent inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections. Minimum qualifications for the masonry inspector shall be 5 years of reinforced masonry inspection experience or acceptance by a State, municipality, or other governmental body having a program of examining and certifying inspectors for reinforced masonry construction. The masonry inspector shall be present during sampling and placing of masonry units, placement of reinforcement, inspection of grout space immediately prior to closing of cleanouts, and during grouting operations. The masonry inspector shall assure Contractor compliance with drawings and specifications, including flashing. The masonry inspector shall keep a complete record of all inspections and shall submit Masonry Inspection Reports and Special Inspection requirements set forth in the structural drawings for inspection requirements and a photographic documentation of flashing.
 - 1. Masonry Inspection: Provide masonry construction inspection of concrete or brick masonry walls indicated as requiring inspection on the Masonry Plans to insure that masonry construction is in conformance with the Contract Documents. Masonry inspection is required for those masonry elements that must be constructed to attain high design strengths.
 - a. Inspection shall use NCMA-TEK 18-03B "Concrete Masonry Inspection" as a guideline.
 - b. The individual or individuals who will perform the masonry inspection shall be present for the Preliminary Masonry Meeting.
 - c. The masonry inspector shall prepare a written report or reports for each day of inspection. Masonry Inspection Report, following this Section, shall be used for all inspection reports. Inspecting reports shall be submitted to the A/E within 5 days of masonry inspection.
 - d. The masonry inspector shall be present and observe all masonry construction operations in walls requiring inspection. The masonry inspector shall be present at the Project site within sufficient time, in advance of grouting operations, to inspect the construction to ensure its conformance to the Contract Documents and that grouting may proceed. No grouting shall be permitted unless the masonry inspector is present and has indicated that the masonry construction is properly prepared for the grouting operation.
 - 2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Level B special inspection according to the "TMS 402," unless otherwise noted.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grouts 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. of wall area or portion thereof.

- E. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140 for compressive strength.
1. Tests of Concrete Masonry Prisms: The Masonry Contractor shall coordinate with a qualified testing laboratory to perform field quality control testing during the masonry work.
 - a. When required by the Masonry Plan, construct a set of 3 masonry prisms using mortar and concrete masonry units to be used in the masonry work. Unless otherwise noted, construct prisms 8 inches by 8 inches by 16 inches high (nominal).
 - b. When prism tests are required to establish the strength of masonry in lieu of Masonry Inspection, provide a minimum of one set of 3 masonry prisms for testing for each 5000 sq.ft. (gross) of masonry wall construction.
 - c. Submit written reports for each prism tested. Provide the project identification name and number, date of report, name of Contractor, name of testing service, name of material suppliers, specific location where masonry represented by the prism is used, compression test strength results, and specified required strength.
 - d. If the compressive strength tests fail to meet the minimum strength specified in the Plans, the masonry represented by the tests shall be considered deficient.
 - e. When tests indicating deficient masonry represent masonry already constructed, such masonry shall be removed and replaced by the Contractor without additional cost to the Owner. In lieu of removal and replacement, additional cores may be grouted as required and directed by the A/E without additional cost to the Owner.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.
- G. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for mortar air content and compressive strength.
1. Tests for Mortar: The Masonry Contractor shall coordinate with a qualified testing laboratory to perform field quality control testing during the masonry mortar work.
 - a. For colored and noncolored mortars test for compressive strength by the methods of sampling and testing of ASTM C109 and ASTM C780.
 - 1) Provide a minimum of six cubes for testing per 5,000 sq.ft. of masonry wall construction and as directed by A/E. Test two cubes at 7 days, two cubes at 28 days, and reserve two cubes for future testing.
 - b. Submit written reports for each material sampled and tested. Provide the project identification name and number, date of report, name of contractor, name of testing service, source of aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate material is acceptable for intended use.
 - c. If the compressive strength tests fail to meet the minimum requirements specified; the mortar represented by such tests would be considered deficient in strength.
 - d. Deficient mortar shall be removed and replaced by the Contractor without additional cost to the Owner.
- H. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

1. Place a piece of preservative-treated wood 1-5/8 inch thick and 3 inch square on a level surface. For masonry units with permeable paper, such as absorptive paper toweling, taped to one face shell are placed around the wood block to form the mold. The resulting mold is approximately 3 inches square by 6 inches high. Measure and record the slump of the grout in accordance with Test Method C143. Pour grout into the mold in two layers. Rod each layer 15 times with a tamping rod to eliminate air bubbles. Rod the bottom layer throughout its depth. Distribute the strokes uniformly over the cross-section of the mold. For the upper layer, allow the stick to penetrate about 1/2 inch into the underlying layer. After the second lift is puddled, level the top of the specimen with a straightedge and immediately cover the specimens with wet burlap or similar material to keep it damp. Protect the specimens against disturbance and extreme changes in temperature, and after 48 hours, remove the masonry units and carefully pack the specimens for transport to the laboratory where they will be stored in a moist room until tested.
2. Cap the specimens in accordance with the applicable provisions of "Method of Capping Cylindrical Concrete Specimens," ASTM C617. The specimens shall be tested in a damp condition in accordance with the applicable provisions of ASTM C39 "Methods of Test for Compressive Strength of Molded Concrete Cylinders."
3. Four test specimens shall be made and tested for each type of grout to be used in the work.
4. As an alternate to the method of sampling described above, grout samples may be formed in grout sample boxes, when requested and approved by A/E.
5. Tests for Grout: The Masonry Contractor shall coordinate with a qualified testing laboratory to perform field quality control testing during the masonry grout work.
 - a. Grout for filling reinforced or unreinforced concrete masonry cores or brick cavities: Test for compressive strength.
 - 1) Provide a minimum of 4 test specimens for testing per 5,000 sq.ft. of masonry wall construction or for each ready mix truckload of grout and as directed by the A/E. Test one cylinder at 7 days, two cylinders at 28 days, and reserve one cylinder for future testing.
 - b. Submit written reports for each material sampled and tested. Provide the project identification name and number, date of report, name of Contractor, name of testing service, source of aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, specific location where material represented by sample is used, slump and compression test results. Indicate whether material is acceptable for intended use.

3.14 REPAIRING, POINTING, AND CLEANING

A. Cleaning, General

1. Know your surface. Positively identify every substrate to be cleaned. Review all manufacturers literature for cleaning recommendations.
2. Always test before overall cleaning. Always test, and always clean under the same conditions you tested under. Retest if conditions change.
3. Use the mildest cleaner and dilution that still gives effective results.
4. Clean early:
 - a. Don't give mortar smears and films a chance to become as hard as the masonry. Get it off while it's still relatively soft. Clean masonry within 7 to 21 days of installation.
 - b. Clay brick may be cleaned within 14 to 28 days.
5. Use the right cleaner for the right job. Follow the masonry manufacturer's guidelines for cleaning each type of masonry.
6. Never clean with raw acid.
7. Cleaning basics
 - a. Don't spare the water. Pre-wetting masonry is recommended. Rinse with 400 psi to remove stains and cleaner residue.
 - b. Clean bottom-to-top, and always keep lower areas wet to prevent streaking.
 - c. Follow all safety precautions in the product literature.

- d. Cold weather
 - 1) Water-saturated masonry is vulnerable to freeze/thaw damage. Never clean if the masonry could freeze before drying.
 - 2) Chemical cleaners and rinse water rely on chemical reactions to dissolve and rinse away construction soiling. Cold temperatures slow these chemical reactions. Compensating for the cold by using a stronger cleaning solution may cause permanent damage to the masonry, especially colored concrete.
 - a) Instead, extend the dwelling time of the properly diluted cleaning solution by 10-20 percent. Scrub areas of heavy soiling with a masonry washing brush. Pre-wetting and rinsing with hot water warms surface and improves results.
 - 3) Schedule wet cleaning for when air and surface temperatures are 40 deg. F. and rising. In cold weather this means your wet-cleaning window may be only a few hours. Use the time before and after to dry-brush and scrape away heavy accumulations of excess mortar and job dirt from the next day's work area.
 - 4) If a limited cleaning window is impractical, enclose the work area with polyethylene and use approved heaters to warm masonry.
 - 5) Warm weather test panels won't work for cold weather cleaning. Test in cold clean in cold.
- B. 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.
 - 1. Provide a 100 square foot area of patched CMU for A/E's review. Do not proceed with patching until area is approved. Wall shall appear uniform from a distance of 5 feet. If masonry units are colored, coordinate blend with unit manufacturer.
- C. 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.
 - 1. Tuckpointing
 - a. Rake mortar joints to a depth of not less than 1/2 inch nor more than 3/4 inch.
 - b. Saturate joints with clean water.
 - c. Fill solidly with pointing mortar.
 - d. Tool joints.
- D. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints. Dry brush exposed masonry with bristle brushes at end of each work day.
 - 1. Promptly remove excess wet mortar containing integral water-repellent mortar admixture from the face of the masonry as work progresses. Do not use strong acids, over-aggressive sandblasting or high-pressure cleaning.
- E. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes or use methods used on approved mock-up. Obtain A/E's approval of sample cleaning before proceeding with cleaning of masonry.
 - a. Where walls are a combination of CMU and brick only the less aggressive CMU cleaners shall be used.
 - b. Comply with applicable environment laws and restrictions.
 - 3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - a. Remove efflorescence in accordance with brick manufacturer's recommendations. Cleaning agents may be used only with approval of masonry unit manufacturer. Cleaning agents must be same as those used on test area.
 - b. If chemical cleaners are to be sprayed on, the pressure shall not exceed 50 psi.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean concrete masonry by cleaning method indicated in NCMA TEK 08-02A and 08-03A, applicable to type of stain on exposed surfaces.
 - a. If additional cleaning is necessary for special CMU, consult with masonry unit manufacturer for approved method. Test method and gain A/E approval before proceeding.
 - b. Water application method shall never exceed 400 psi without approval of A/E.
8. Clean stone trim to comply with stone supplier's written instructions.

3.15 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. Excess Masonry Waste: Remove excess clean masonry waste and other masonry waste, and legally dispose of off Owner's property.

3.16 LIST OF SPECIAL INSPECTIONS

TABLE 1.19.2 (TMS 402-11)				
LEVEL B QUALITY ASSURANCE				
VERIFICATION AND INSPECTION	Frequency		Reference for Criteria	
	CONTINUOUS	PERIODIC	TMS 402	TMS 602
1. Verification of slump flow and VSI as delivered to the site for self-consolidating grout.	X	--	--	Art. 1.5 B.1.b.3
2. Verification of f'_m prior to construction except where specifically exempted by this code.	--	X	--	Art. 1.4 B
3. Compliance with required inspection provisions of the construction documents and the approved submittals shall be verified.	---	X	---	Art. 1.5
4. As masonry construction begins, the following shall be verified to ensure compliance:				
a. Proportions of site-prepared mortar.	--	X	--	Art. 2.1, 2.6 A
b. Construction of mortar joints.	--	X	--	Art. 3.3 B
c. Location of reinforcement and connectors.	--	X	--	Art. 3.4
5. During construction the inspection program shall verify:				
a. Size and location of structural elements.	--	X	--	Art. 3.3 F
b. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction.	--	X	Sec. 1.16.4.3, 1.17.1	--
c. Preparation, construction and protection of masonry during cold weather (temperature below 40 deg. F) or	--	X	--	Art. 1.8 C, 1.8 D

hot weather (temperature above 90 deg F.)				
d. Placement of grout is in compliance	X	--	--	Art. 3.5
6. Prior to grouting, the following shall be verified to ensure compliance.				
a. Grout space.	--	X	--	Art. 3.2 D, 3.2 F
b. Grade, type, and size of reinforcement and anchor bolts.	--	X	Sec. 1.16	Art. 2.4, 3.4
c. Placement of reinforcement and connectors.	--	X	Sec. 1.16	Art. 3.4
d. Proportions of site-prepared grout.	--	X	--	Art. 2.6 B
e. Construction of mortar joints.	--	X	--	Art. 3.3 B
7. Preparation of any required grout specimens, mortar specimens and/or prisms shall be observed.	--	X	--	Art. 1.4

END OF SECTION 04 20 00.00

05 METALS

DIVISION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. General: The extent of metal fabrications includes items fabricated from iron and steel shapes, plates, bars, strips, tubes, pipes, and castings which are not a part of structural steel systems in these Specifications.
 - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 3. Loose Steel Lintels.
 - 4. Steel columns.
 - 5. Post-installed, torque-controlled expansion anchors.
 - 6. Abrasive metal nosings.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
 - 2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
 - 3. Division 06 Section "Rough Carpentry" for metal framing anchors.
 - 4. Division 33 Section "Utility Services" for metal downspout boots.

1.2 COORDINATION

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

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Adhesive anchor bolts.
 - 2. Post-installed, torque-controlled expansion anchors.
 - 3. Metal Nosings.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 - a. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - b. Miscellaneous steel trim including steel edgings.
 - c. Steel columns.
 - 2. Provide templates for anchors and bolts specified for installation under other Sections.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Structural fasteners shall be manufactured in the United States. Fabricator shall furnish proof of U.S. manufacturer. If it becomes necessary to use imported fasteners, each size, type, and each large quantity package (500 pcs. or more) shall undergo a random sampling of a minimum 5 pieces for testing. Test results are to be provided to A/E. Test shall be performed by an independent testing agency, and the cost shall be included in the Base Bid. If inferior fasteners are discovered, all fasteners of that type shall be removed and replaced with acceptable fasteners at no cost to the Owner. If possible, fasteners shall be tested prior to use in construction.
 - 2. Ladders: Product design shall comply with OSHA 1910.27 minimum standards.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1 "Structural Welding Code – Steel."
- C. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
- D. Post-Installed Torque-Controlled expansion Anchors and Adhesive Anchor Bolts: Installers of post-installed anchors shall undergo a manufacturer's training program or be provided with on-site instruction for proper installation from a manufacturer's representative.

1.5 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.
 - 3. Basis-of-Design Product: The design for each product type is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany request for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.3 METALS, GENERAL

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

2.4 FERROUS METALS

- A. W-Shapes: ASTM A 992.
- B. Channels, Angles, M, S-Shapes: ASTM A 36 or ASTM A 572, Grade 50.
- C. Steel Plates, Shapes, and Bars: ASTM A 36.
- D. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- E. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- F. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 inch wide single and double channels as required.
 - 2. Material: Steel complying with ASTM A 1011, structural steel, Grade 33; 0.0528-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
 - 3. Fittings: Fabricate from steel that meets or exceeds the physical requirements of ASTM A1011 SS Grade 33 and conforms to one of the following ASTM specifications:
 - a. A1011 SS Grade 33
 - b. A575
 - c. A576
 - d. A36
 - e. A635
- G. Cast Iron: Either gray iron ASTM A 48, or malleable iron, ASTM A 47, unless other indicated or required by structural loads.

2.5 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304, Type 316 within pool/natatorium environment, stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, or ASTM F 1941 Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
- B. High-Strength Bolts, Nuts, and Washers: ASTM F 3125, Grade A 325, Type 3, heavy-hex steel structural bolts; ASTM A 563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.

- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1 and Group 2 within natatorium/pool environment.
- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- F. Eyebolts: ASTM A 489.
- G. Machine Screws: ASME B18.6.3.
- H. Lag Bolts: ASME B18.2.1.
- I. Wood Screws: Flat head, ASME B18.6.1.
- J. Plain Washers: Round, ASME B18.22.1.
- K. Lock Washers: Helical, spring type, ASME B18.21.1.
- L. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM F 2329.
- M. Post Installed, Torque-Controlled Expansion Anchors: Anchor bolt and sleeve assembly satisfying the cracked concrete requirements of ICC-ES AC 193 with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Products:
 - a. Kwik Bolt 1 or Kwik Bolt-TZ2; Hilti, Inc.
 - b. Strong Bolt II; Simpson Strong-Tie Company, Inc.
 - c. Truebolt+; ITW Ramset/Red Head
 - 2. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5 or ASTM F 1941, Class Fc/Zn5, unless otherwise indicated.
 - 3. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.
- N. Adhesive (Chemical) Anchor Bolts (In Concrete): Chemically grouted adhesive (chemical) anchor bolts satisfying the cracked concrete requirements of ICC-ES AC 308. Subject to compliance with requirements, provide one of the following:
 - 1. Products:
 - a. HY 200 Safe Set system or RE 500 V3 Safe Set; Hilti, Inc.
 - b. Ceramic 6 EPCON System Adhesive Anchors; ITW Ramset/Red Head.
 - c. Simpson Set Epoxy-Tie Adhesive Anchors; Simpson Strong-Tie Company, Inc.
 - 2. Anchors to be ASTM A36 or A307, zinc plated steel threaded rods ($F_y = 36$ ksi) unless otherwise noted.
 - 3. Where noted on the drawings anchors to be ASTM F593, Condition CW stainless steel threaded rods ($F_y = 65$ ksi for diameters 3/8 inch through 5/8 inch and $F_y = 45$ ksi for diameters 3/4 inch through 1-1/4 inch).
 - 4. Anchors to be installed in strict conformance to manufacturer's installation instructions.

5. Adhesive Anchors shall have the following minimum allowable load capacities: (Based on embedment in 4000 psi concrete and a minimum safety factor on ultimate load capacities of 3.5. Use proportional allowable loads for other strengths of concrete. Note: Actual anchor load capacity varies with spacing and edge distance.)

<u>Size</u>	<u>Allowable Shear</u>	<u>Allowable Tension</u>	<u>Minimum Embedment</u>
3/8 inch	1000 lbs.	2100 lbs.	3-3/8 inch
1/2 inch	1850 lbs.	3300 lbs.	4-1/4 inch
5/8 inch	2900 lbs.	5100 lbs.	5 inches
3/4 inch	4200 lbs.	6800 lbs.	6-5/8 inch
1 inch	7500 lbs.	11,000 lbs.	8-1/4 inch

O. Adhesive Anchor Bolts (In Masonry)

1. In hollow CMU: Chemically grouted adhesive anchor systems with nylon or stainless steel screen inserts.
 - a. Products:
 - 1) HIT HY270 Adhesive Anchors, Hilti, Inc.
 - 2) Ceramic 6 EPCON System, ITW/Ramset/Red Head
 - 3) Simpson Set Epoxy-Tie Adhesive Anchors, Simpson Strong-Tie Company, Inc.
2. In solid grouted CMU: Chemically grouted adhesive anchor systems. If voids in grout are encountered, use adhesive anchor bolts specified above for hollow CMU.
 - a. Products:
 - 1) HIT-ICE (Cold Weather) or HY270 (Hot Weather) Adhesive Anchors, Hilti, Inc.
 - 2) Ceramic 6 EPCON System, ITW/Ramset/Redhead
 - 3) Simpson Set Epoxy-Tie Adhesive Anchors, Simpson Strong-Tie Company, Inc.
3. Anchors to be ASTM A36 or A307 zinc plated steel threaded rods ($F_y = 36$ ksi) unless otherwise noted.
4. Where noted on the drawings, anchors to be ASTM F593, Condition CW stainless steel threaded rods ($F_y = 65$ ksi for diameters 3/8 inch through 5/8 inch and $F_y = 45$ ksi for diameters 3/4 inch through 1-1/4 inch).
5. Anchors to be installed in strict conformance to manufacturer's installation instructions.
6. Adhesive anchors shall have the following minimum allowable load capacities: (Based on $F'_m = 1500$ psi, grout with $f'_c = 2500$ psi at 28 days and a minimum safety factor on ultimate load capacities of 3.5. Note: Actual anchor load capacity varies with spacing and edge distance.)

a. In Hollow CMU:

<u>Size</u>	<u>Allowable Shear</u>	<u>Allowable Tension</u>	<u>Minimum Embedment</u>
3/8 inch	600 lbs.	500 lbs.	2 inch
1/2 inch	900 lbs.	500 lbs.	2 inch

b. In Solid Grouted CMU:

<u>Size</u>	<u>Allowable Shear</u>	<u>Allowable Tension</u>	<u>Minimum Embedment</u>
1/2 inch	1200 lbs.	1400 lbs.	4-1/4 inch
5/8 inch	1600 lbs.	1800 lbs.	5 inch
3/4 inch	1600 lbs.	2900 lbs.	6-5/8 inch

7. Adhesive anchor bolt suppliers shall submit product data, including certified test results showing the ultimate and allowable shear and tension load capacities for all anchors sizes and types to be furnished.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Epoxy Zinc-Rich Primer: Complying with MPI #20 and compatible with topcoat.
- D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187 or SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert type noncorrosive compound free of asbestos fibers, sulfur compounds, and other deleterious impurities.
- G. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 LOOSE BEARING AND LEVELING PLATES

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

2.8 ABRASIVE METAL NOSINGS

- A. Cast-Metal Units: Cast aluminum with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
 - 1. Manufacturers:
 - a. American Safety Tread Co., Inc.
 - b. Balco Inc.
 - c. Barry Pattern & Foundry Co., Inc.
 - d. Safe-T-Metal Co.
 - e. Wooster Products Inc.
 - f. Granite State Casting Co.
 - 2. Nosings: Cross-hatched units, 4 inches wide with 1/4-inch lip, for casting into concrete steps.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Apply bituminous paint to concealed surfaces at cast-metal units.

2.9 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible to minimize field splicing and assembly. 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, 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 true to line and level 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 where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.10 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 retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts if units are installed after concrete is placed.
- C. Prime miscellaneous framing and supports with where indicated.

2.11 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel stud anchors for embedding in concrete.
 - 1. Galvanize exterior weld plates, bent plates and angles serving as door jambs.

2.12 LOOSE STEEL LINTELS

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

2.13 FINISHES, GENERAL

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

2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123, for galvanizing steel and iron products.
 - 2. ASTM A 153, for galvanizing steel and iron hardware.
 - 3. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items, not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer, unless indicated.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Paint items embedded in concrete with two coats of bituminous paint.
 - 2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Installer shall examine areas and conditions under which miscellaneous metal items shall be installed. Notify Contractor in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.2 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 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 bolts, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Coat concealed surfaces of steel embedded in concrete with two coats of bituminous paint.
- G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
- H. Lintels and Shelf Angles: Weld or bolt members together where indicated.
 - 1. Lintels shall have 8 inch bearing at each end, minimum, unless shown otherwise. Bearing pressures shall not exceed the allowable stress for masonry.
 - 2. Where shelf angles are attached to concrete with bolts and adjustable inserts, provide slotted holes of proper size and spacing in the vertical leg of shelf angles.
- I. Set structural steel accurately in locations and to elevations indicated and according to:
 - 1. AISC 303 and AISC 360
 - 2. OSHA Construction Industry Standards (29 CFR 1926)
 - 3. Specified requirements

3.4 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

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

3.5 INSTALLING BEARING AND LEVELING PLATES

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

3.6 INSTALLATION OF MISCELLANEOUS STEEL TRIM

- A. Anchor to concrete construction to comply with manufacturer's written instructions.

3.7 INSTALLING NOSINGS, TREADS AND THRESHOLDS

- A. Center nosings on tread widths.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

3.8 ADJUSTING AND CLEANING

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

END OF SECTION 05 50 00

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Aluminum pipe and tube railings (exterior).
- B. Mark furnished but installed under other Sections:
 - 1. Furnish sleeves and anchors to be cast in concrete to Division 03 Section "Cast-in-Place Concrete".
- C. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for additional requirements for chemical anchors.

1.2 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Grout, anchoring cement, and paint products.
 - 3. Railing brackets.
- B. Shop Drawings: For all railing systems, including:
 - 1. Splices and attachments.
 - 2. Identify location of all railing systems.
 - 3. Indicate railing systems in related and dimensional position, with elevations at scale of 1/4 inch equals 12 inches and details at scale of 3 inch equals 12 inch (1:5) or larger.
 - 4. Show all details and dimensions not governed by field conditions.
 - 5. Indicate all required field measurements.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2, "Structural Welding Code--Aluminum."
- B. Engineer Qualifications: Professional engineer legally authorized to practice in the jurisdiction where Project is located and experienced in providing engineering services of the kind indicated for handrails and railing systems similar to this Project in material, design, and extent, and that have a record of successful in-service performance.

1.5 FIELD CONDITIONS

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

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.
- C. Storage on Site
 - 1. Store material in a location and in a manner to avoid damage. Stacking shall be done in a way which will prevent bending.
 - 2. Store aluminum, bronze, and stainless steel components and materials in a clean, dry location, away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that will permit circulation of air inside the covering.
- D. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of materials.
 - 1. Refer to NAAMM Manual AMP 555-92, Code of Standard Practice for the Architectural Metal Industry, Sections 6 and 7.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design railings, posts, and attachments to adjoining construction, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: In engineering railings and posts to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
- C. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.

- D. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.3 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.
 - 1. Provide bracket that provides 1-1/2 inch clearance from inside face of handrail to finished wall surface.

2.4 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- B. Extruded Bars and Tubing: ASTM B 221, Alloy 6063-T5/T52.
- C. Extruded Structural Pipe and Round Tubing: ASTM B 429, Alloy 6063-T6.
 - 1. Provide Standard Weight (Schedule 40) pipe, unless otherwise indicated.
- D. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.
- E. Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- F. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.
- G. Castings: ASTM B 26, Alloy A356.0-T6.

2.5 FASTENERS

- A. General: Provide the following:
 - 1. Aluminum Railings: Type 304 stainless-steel fasteners.
 - 2. Provide exposed fasteners with finish matching 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 indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

- D. Post-Installed Anchors: Provide chemical, anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
1. Refer to Division 05 Section "Metal Fabrications."
- E. Brackets, Flanges, Fittings and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of handrails and guards to other work. Furnish inserts and other anchorage devices for connecting handrails and guards to concrete and masonry work.
1. Wall Bracket: Castaluminum wall mount handrail bracket with a projection of 2-1/2 inch. Bracket shall have one 3/8 – 16 tapped hole for concealed mounting and universal saddle with two countersunk mounting holes.
 - a. Manufacturers
 - 1) Julius Blum & Co.
 - 2) R&B Wagner, Inc.
 - 3) J.G. Braun Co.
 2. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
 3. Ease corners and edges of brackets. Brackets shall not have sharp edges.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for exterior applications.
- D. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
1. Water-Resistant Product: Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.7 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. 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 equally spaced per code requirements between top rail and finish floor or nosing line of tread.
 3. Locate intermediate rails.

- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water or condensation may accumulate.
 - 1. Weeps should be set such that the post base does not hold water. A pourable sealer can be used within the post to fill the hollow portion of the post up to the level of the weep or provide condensation sleeves or diverters.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with either welded or nonwelded connections, unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. Weld exposed corners and seams continuously, unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds; completely sanded joint, some undercutting and pinholes okay.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Form changes in direction as follows:
 - 1. By bending or by inserting prefabricated elbow fittings.
- K. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of railing members with prefabricated end fittings or by welding metal closure in place.
- M. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- O. 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.

2.8 ALUMINUM FINISHES

- A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are 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.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings.
 - 1. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 - 2. Fit exposed connections together to form tight, hairline joints.
 - 3. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 - 4. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 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.
- C. Corrosion Protection: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.
 - 1. Steel: Provide expansion joints on straight runs exceeding 40 feet.
 - 2. Aluminum: Provide expansion joints on straight runs exceeding 20 feet.

3.4 ANCHORING POSTS

- A. Tolerance: Set posts plumb and aligned to within 1/4 inch in 12 feet.
- B. Setting Posts, General:
 - 1. Clean dust and foreign matter from sleeves/holes.
 - 2. Moisten interior of holes and surrounding surfaces with clean water.
 - 3. Prepare and use grout in accordance with manufacturer's directions.
 - 4. Place posts in position and brace until grout sets.
 - 5. Pour mixture into annular space until it overflows the hole.
 - 6. Wipe off excess and leave 1/8 inch build-up sloped away from post.
- C. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
 - 1. Exterior Locations: Use anchoring cement.
- D. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.

3.5 ANCHORING RAILING ENDS

- A. Tolerances: Set rails horizontal or parallel to rake of steps or ramp to within 1/4 inch in 12 feet.
- B. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.
- C. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

3.6 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Use type of bracket with predrilled hole for exposed bolt anchorage.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - 1. Aluminum Pipe: Spacing shall not be more than 5 feet.
- C. Secure wall brackets to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For steel-framed gypsum board partitions, fasten brackets either directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads or with toggle bolts installed through flanges of steel framing or through concealed steel reinforcements or use hanger or lag bolts set into fire-retardant-treated wood backing between studs.

3.7 ADJUSTING AND CLEANING

- A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.
 - 1. Do not use acid solution, steel wool or other harsh abrasives.

3.8 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 05 52 13

06

DIVISION

WOODS, PLASTICS, AND COMPOSITES

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Framing with dimension lumber.
 - 2. Wood blocking and nailers.
 - 3. Miscellaneous plywood.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for post-installed anchors and steel framing.
 - 2. Division 06 Section "Sheathing" for sheathing, subflooring, and underlayment.
 - 3. Division 26 Section "General Electrical Panels" for plywood backing panels.

1.2 DEFINITIONS

- A. Exposed Framing: Framing not concealed by other construction.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- C. Timber: Lumber of 5 inches nominal or greater in least dimension.
- D. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- E. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NLGA: National Lumber Grades Authority.
 - 3. RIS: Redwood Inspection Service.
 - 4. SPIB: The Southern Pine Inspection Bureau.
 - 5. WCLIB: West Coast Lumber Inspection Bureau.
 - 6. WWPAA: Western Wood Products Association.

1.3 PREINSTALLATION MEETING

- A. Pre-installation Meeting: Conduct meeting at Project site, unless otherwise noted. Attendees shall include installers whose work requires in-wall blocking.
 - 1. Review in-wall blocking.
 - 2. Distribute information on items furnished by the Owner and installed by the Contractor.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Lumber Supplier product data with species, grade and structural properties.
 - a. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
 - 2. Metal framing anchor products.
 - 3. 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.
 - a. Indicate compliance with AWWA requirements.
 - b. Indicate products contain no arsenic or chromium.
 - 4. 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.

1.5 QUALITY ASSURANCE

- A. Environmental Conditions:
 - 1. Preservative treatment shall not contain hazardous materials as arsenic or chromium. Chromated copper arsenate (CCA) and ammoniacal copper zinc arsenate (ACZA) shall not be used.
 - 2. Composite wood products shall be labeled or show compliance with the Toxic Substances Control Act (TSCA) Title VI.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers 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.

1.7 FIELD CONDITIONS

- A. Installer must examine the substrates and supporting structure and the conditions under which the Carpentry Work is to be installed; and notify the A/E in writing of conditions detrimental to the Work. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- B. Coordination: Fit Carpentry Work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow proper attachment of other work.
 - 1. Contractor shall confirm with roofing system manufacturer that wood that covers into contact with roof membrane is compatible and acceptable.
 - 2. Time delivery and installation of carpentry to avoid delaying other operations whose work is dependent and or effected by the carpentry work, and to comply with protection and storage requirements.
 - 3. Protect installed carpentry from damage due to other work activities and weather.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Installed wood blocking shall be secured to the building structure to provide an attachment point for the specified products and assemblies.
- B. Material Compatibility: Provide wood materials that are compatible with the building structure, fasteners, and other materials that will be in contact with the wood materials. Provide separator materials where required to prevent compatibility issues.

2.2 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
 - 3. 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 lumber.
 - 4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent.

2.3 WOOD-PRESERVATIVE-TREATED LUMBER (WPTL)

- A. Preservative Treatment by Pressure Process: AWPA U1, use categories as follows:
 - 1. UC2: Interior construction not in contact with ground, but may be subject to moisture.
 - 2. 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 hazards.
 - 3. UC4A (Commodity Specification A): Non-critical sawn products in contact with ground and exposed to all weather cycles including continuous or prolonged wetting, and sawn products not in contact with ground, but with ground contact-type hazards or that are critical or hard to replace.
 - 4. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 - a. Unless otherwise noted: Use one of the following formulations of inorganic boron.
 - 1) Sodium-octaborate (SBX) or disodium-octaborate-tetrahydrate (DOT).
 - 2) Zinc borates (ZB) for treating engineered wood or wood composites during the manufacturing process.
- B. Kiln-dry or air-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.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
 - 3. Wood floor plates that are installed over concrete slabs-on-grade.

2.4 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 3 grade of any species.
 - 1. Application: Interior partitions not indicated as load bearing.
- B. Load-Bearing Walls and Shear Walls: No. 2 Southern Yellow Pine.
 - 1. Application: Exterior walls and interior load-bearing partitions and shear walls.
- C. Ceiling Joists: Construction, Stud, or No. 3 grade of any species.
- D. Joists, Rafters, and Other Framing: No. 1 Southern Yellow Pine.

2.6 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
- B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content of any species.
 - 1. Provide No. 2 grade Douglas Fir or Southern Yellow Pine nailers associated with roofing and roof flashing.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine, No. 3 grade; SPIB.
 - 2. Hem-fir or hem-fir (north), Standard or 3 Common grade; NLGA, WCLIB, or WWP.

3. Spruce-pine-fir (south) or spruce-pine-fir, Standard or 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.7 MISCELLANEOUS PLYWOOD PANELS

- A. General: Where plywood panels will be used for the following concealed types of applications, provide APA performance rated panels complying with requirements indicated for grade designation, span rating, exposure durability classification, edge detail (where applicable), and thickness.
 1. Plywood Shims, Nailers, and Blocking for Roof Insulation Stops: Shall be APA UNDERLAYMENT C-C PLUGGED EXT.
 2. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4 inch nominal thickness.

2.8 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
 1. Where rough carpentry is exposed to weather, in ground contact, preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153 or of Type 304 stainless steel.
 - a. Provide Class D coating for fasteners 3/8-inch diameter and less. Provide Class C coating for larger fasteners.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
 1. Exception: Powder-activated/actuated fasteners that involve a projectile propelled by a charge of carbon-dioxide or gun powder are not allowed.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
- H. Post-Installed Anchors: Refer to Division 05 Section "Metal Fabrications".

2.9 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cleveland Steel Specialty Co.
 2. Phoenix Metal Products, Inc.
 3. MiTek Industries, Inc.
 4. Simpson Strong-Tie Co., Inc.
 5. Tamlyn.
- B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G185 coating designation.
1. Use for interior locations where stainless steel is not indicated.
- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
1. Use for wood-preserved-treated lumber where indicated.
- E. Joist Hangers: U-shaped joist hangers with 2-inch- long seat and 1-1/4-inch- wide nailing flanges at least 85 percent of joist depth.
1. Thickness: 0.062 inch.
- F. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
1. Strap Width: 1-1/2 inches.
 2. Thickness: 0.062 inch.
- G. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and spacing.
- H. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fastens to side of rafter or truss, face of top plates, and side of stud below.
- I. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.
- J. Wall Bracing:
1. T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches wide by 9/16 inch deep by 0.034 inch thick with hemmed edges.
 2. Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch thick with hemmed edges.

2.10 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Provide one of the following:
1. Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
 2. Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
 3. Self-adhering sheet consisting of 64 mils of rubberized asphalt laminated on one side to a 4-mil-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.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- D. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- E. Do not splice structural members between supports, unless otherwise indicated.
- F. 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.
- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- H. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- I. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
 - 1. Partial boards shall be fastened at a rate commensurate with full boards and shall have not less than two (2) fasteners per piece.
- J. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- K. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. ICC-ES ESR-1539 for power-driven fasteners.
- L. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

- M. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 - 1. Use finishing nails, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
 - 1. Install additional fasteners, as required to counteract minor warpage or variances in substrate, and to hold tight and true to lines.
 - 2. When using multiple nailer courses, weave corners and stagger end joints a minimum of 3 feet from underlying course.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- C. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- D. Wood Nailers at Roof: Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imported by project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7. Minimum thickness of nailers must be such that the top of the nailer is flush with the top of the membrane underlayment. Wood nailers are required in any situation where 1 inch or greater of insulation is added to the roof perimeter edge.
 - 1. Wood nailers shall be #2 FRTM treated lumber or better and shall be fastened to the deck, wall, or existing secure nailer in such a manner that they resist 300 lbs. of force per ft. of nailer in any direction. Fasteners used to attach wood nailers shall be spaced no greater than 18 inches apart and no less than 6 inches from end. Fasteners shall be staggered 1/3 nailer width. Nailer attachment shall meet hereinbefore requirements and those of Factory Mutual Loss Prevention Data Sheet 1-49.
- E. Wood Nailers at Flashing and Sheet Metal: Minimum thickness of the nailers must be such that the top of the nailers are flush with the top of the membrane underlayment.
 - 1. Wood nailers are required for securement of metal edgings, scuppers, insulated pipes.
 - a. The width of the wood nailers shall be 5-1/2 inches minimum, and must exceed the width of the metal flange of edgings and insulated metal collars by 1/2 inch.
 - 2. Wood nailers must be #2 FRTM grade lumber or better and shall be fastened to the deck or wall in such a manner that they resist 300 pounds of force per linear foot of nailer in any direction. Fasteners used to attach wood nailers must be spaced no greater than 18 inches apart. Wood nailers are required in any situation where 1 inch or greater of insulation is added to the roof perimeter edge. Top of the nailers must be flush with the top of the roof membrane underlayment. Wood nailers are not required at a change of plane such as the intersection between a parapet wall and the decking.
- F. Wood blocking, nailers, and grounds shall be provided as necessary to receive woodwork, lockers, cabinets, and other finish items.

3.3 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction, unless otherwise indicated.
 - 1. For exterior walls, provide 2-by-nominal- size, size as indicated on drawings, wood studs spaced 16 inches o.c., unless otherwise indicated.

2. For interior partitions and walls, provide 2-by- nominal size, size as indicated on drawings, wood studs spaced 16 inches o.c., unless otherwise indicated.
 3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
 2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated or, if not indicated, according to Table R502.5(1) or Table R502.5(2), as applicable, in ICC's International Residential Code for One- and Two-Family Dwellings.

3.4 CEILING JOIST AND RAFTER FRAMING INSTALLATION

- A. Provide special framing as indicated for overbuilds, eaves, overhangs, dormers, and similar conditions, if any.
- B. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal- size or 2-by-4-inch nominal- size stringers spaced 48 inches o.c. crosswise over main ceiling joists.
- C. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
 2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- D. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal- size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.

3.5 PROTECTION

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

END OF SECTION 06 10 00

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Wall sheathing.
 - 2. Roof sheathing.
 - 3. Sheathing joint-and-penetration treatment.
- B. Related Sections include the following:
 - 1. Division 06 Section "Rough Carpentry" for miscellaneous plywood panels.
 - 2. Division 07 Section "Vapor-Retarding Fluid-Applied Membrane Air Barriers".
 - 3. Division 07 Section "Thermal Insulation" for insulation within framing.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting; Convene prior to commencing work of this Section. Review installation procedures and coordination required with "Related Work" and the following:
 - 1. Participants: Authorized representatives of the Contractor, A/E, installer, and manufacturer.
 - 2. Review wall assemblies for potential interference and conflicts and coordinate layout and support provisions for interfacing work.
 - 3. Review continuous insulation wall panels installation methods and procedures related to application, including manufacturers, installation guidelines.
 - 4. Review firestopping requirements and weather resistive membrane requirements and placement locations.
 - 5. Review field quality control procedures.
- B. Sequencing
 - 1. Coordinate with installation of weather and air barrier systems.
 - 2. Ensure that products of this Section are supplied to affected trades in time to prevent interruption of construction progress.
 - 3. Do not install products under environmental conditions outside manufacturer's absolute limits.
 - 4. Installation of ventilated insulation shall be coordinated with the roofing subcontractor so the roofing is applied as soon as possible after insulation is in place.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Product data for all sheathing products and accessories.
 - 2. Include data for wood-preservative 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.
 - 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings. Protect sheathing from weather by covering with waterproof sheeting, securely anchored.
- B. Install no more insulation in one day than can be covered the same day with underlayment or membrane flashing.
 - 1. Do not expose insulation to excessive heat, sparks, or open flame.

- C. Composite wood products shall be labeled or show compliance with the Toxic Substances Control Act (TSCA) Title VI.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide product by the manufacturers specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- B. Continuous Insulation (Wall Sheathing): Products shall meet the continuous insulation standards of ASHRAE 90.1 and applicable Building Codes for commercial exterior wall applications in accordance with requirements of authorities with jurisdiction.
 - 1. Code Compliance: Exterior Insulation (Sheathing): Class A or Class B Flame spread index and < 450 Smoke Developed Index) classified at maximum thickness per UL 723 criteria or ASTM E 84 criteria.

2.3 WOOD PANEL PRODUCTS, GENERAL

- A. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.
- B. Oriented Strand Board: DOC PS 2.
- C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- D. Factory mark panels to indicate compliance with applicable standard.

2.4 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC36 for exterior construction not in contact with ground, and Use Category UC4a for items in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - a. Unless otherwise noted: use one of the following formulations of inorganic boron.
 - 1) Sodium-octaborate (SBX) or disodium-octaborate-tetrahydrate (DOT).
 - 2) Zinc borates (ZB) for treating engineered wood or wood composites during the manufacturing process.

- b. For sleepers, sill plates and for wood that will be installed in a location where it will be in contact with the ground or will be exposed to liquid water (continuously or periodically), use one of the following copper formulations:
 - 1) Alkaline-copper-quat (quaternary ammonium) (ACQ)
 - 2) Copper acrolein, Type B (CA-B).
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat only items indicated on Drawings and the following:
 - 1. Plywood in contact with masonry or concrete.

2.5 WALL SHEATHING

- A. Plywood Wall Sheathing: Exposure 1, Structural I sheathing (CDX).
 - 1. Span Rating: Not less than 24/0.
 - 2. Nominal Thickness: Not less than 7/16 inch or as indicated on Drawings.
- B. Foil-Faced, Polyisocyanurate-Foam Wall Sheathing: ASTM C 1289, Type I or Type II, Class 2, rigid, cellular, polyisocyanurate thermal insulation. Foam-plastic core and facings shall have a flame-spread index of 25 or less when tested individually.
 - 1. Manufacturers:
 - a. Hunter Panels
 - b. Atlas Roofing Corp.
 - c. Carlisle Coatings and Waterproofing Inc.
 - d. DuPont
 - e. Remax, Inc.
 - 2. Thickness: As indicated
 - 3. Thermal Resistance R-Value: 6.5 per inch.
 - 4. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

2.6 ROOF SHEATHING

- A. Plywood Roof Sheathing: Exposure 1, Structural I sheathing (CDX).
 - 1. Span Rating: Not less than 32/16.
 - 2. Nominal Thickness: Not less than 5/8 inch unless otherwise noted.

2.7 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 and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153 or Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

2.8 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.9 INSULATED WALL SHEATHING ACCESSORIES

- A. Liquid Spray Flashing: Provide insulation manufactured recommended board joint commercial liquid spray flashing and sealant for sealing joints, seams, window openings, door openings, counterflashing and penetrations through the insulation layers.
 - 1. Meets ASTM 331 water penetration of existing windows by uniform static air pressure differences, as part of an approved assembly with continuous foam insulation.
- B. Flashing Tape: Provide insulation manufactured recommended tape for counterflashing and penetrations through the insulation layer.
 - 1. Meets ASTM D3330 standard test method for peel adhesion for pressure sensitive tape.
 - 2. Water vapor transmission less than 1 perm.
 - 3. Application Temperature: 30 degrees F to 120 degrees F.
 - 4. UV Resistance: 120 days.
- C. Penetration Filler: Provide insulated sheathing manufacturer's recommended polyurethane foam for sealing penetrations of insulated sheathing.
 - 1. Meets ASTM E84 standard test method for surface burning characteristics of building materials.
 - 2. Meets Modified ASTM E814 standard test method for fire block.
 - 3. Complies with Underwriters Laboratories, Inc. classification, as a sealant fire block.

2.10 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with ADAAFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and installation conditions for compliance with requirements for installation conditions affecting performance of the work.
 - 1. Verify that wall studs, opening framing, bridging, bracing, and other framing support members and anchorage have been installed within wall system alignment tolerances and requirements.
 - a. Verify that all exterior wall assembly construction has been completed to the point where the sheathing may correctly be installed.
 - 2. Verify that items required to penetrate the wall system are placed and penetration gaps and cracks can be sealed to prevent water penetration.
 - 3. Verify that mechanical and electrical services in walls have been installed and tested and, if appropriate, verify that adjacent materials and finishes are dry and ready to receive sheathing.
- B. Roof Deck: The structural roof deck shall be smooth and level and free of water or debris before insulation is installed.
- C. Do not proceed with wall system installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION, GENERAL

- A. General: Install in accordance with manufacturer's instructions.

- B. 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.
 - 1. Install in exterior spaces without gaps or voids. Do not compress insulation.
- C. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
 - 1. Fit tight in spaces and tight to exterior code of mechanical and electrical services within place of insulation.
- D. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. ICC-ES ESR-1539 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
- E. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- F. Coordinate wall 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.
- G. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- H. 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.

3.4 WOOD STRUCTURAL PANEL INSTALLATION

- 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. Nail to wood framing.
 - b. Space panels 1/8 inch apart at edges and ends.

3.5 INSULATED WALL SHEATHING INSTALLATION

- A. Comply with manufacturer's written instructions. Fasten to exterior face of exterior face of exterior stud walls using sheathing manufacturer's recommended type and length screw fasteners with washers. Abut panels tightly together and around openings and penetrations.
 - 1. Install in exterior spaces without gaps or voids. Do not compress insulation.
 - a. Fill voids with spray foam insulation. Refer to Division 07 Section "Thermal Insulation".
 - 2. Trim sheathing/insulation neatly to fit spaces.
 - 3. Coordinate with the cladding or mason for the attachment requirements over sheathing/insulation.
 - 4. Exposed insulation must be protected from open flame and kept dry at all times.
 - 5. Install sheathing panels horizontally with aluminum facing to exterior. Use maximum lengths to minimize number of joints. Locate edge joints parallel to and on framing. Center end joints over supports and stagger in each course. Provide additional framing wherever panel joints do not bear against framing plate or sill members.

6. Fasten panels to each support with fasteners spaced 12 inches on center at perimeter of the wall and 16 inches on center in panel field. Set back perimeter fasteners 3/8 inch from edges and ends of panel units. Drive fasteners to bear tight and flush with surface of insulation. Do not overdrive fastener causing damage to the insulation board facer. Perimeter fasteners can be detailed to bridge the gap of abutting board joints due to the 2 inch diameter of the washer used to fasten the board to studs. Maximum of two board joints may be bridged per fastener.
7. Install flashing at end and edge joints in accordance with sheathing manufacturer's joint sealing recommendations.
8. Seal sheathing joints and penetrations of sheathing in accordance with sheathing manufacturer's joint and penetration sealing recommendations.
9. After base flashing, which includes a termination bar running horizontally along the top edge of the flashing, is installed on exterior of insulated sheathing install either liquid spray flashing or flashing tape to the exterior sheathing and lapped over the top edge of the base. A flat strap must be included in framing at termination bar height to allow proper fastening of the termination bar.

B. Flashing and Sealant Installation

1. General: Apply spray in a well-ventilated area to ensure optimal product curing.
 - a. Surface and ambient temperatures should be 35 degrees F and rising and below 120 degrees F during the application.
 - b. Do not apply product on surface with standing water or frost.
2. Liquid spray flashing tolerates rain shortly after the curing process has begun (typically 1 to 4 hours); avoid installing on days with a high probability of significant rainfall.
3. Seal any gaps greater than 1/4 inch with insulating foam sealant or compatible sealant according to manufacturer's recommendations prior to applying liquid spray flashing. If facer on insulation board is damaged note the affected area so that additional spray can be applied appropriately. Damaged insulation can also be replaced or flashing tape can be used to tape down facer flaws.
4. Flash board joints, penetrations and other fenestration openings as required. Spray can be applied on one or two passes depending on site conditions.
5. Apply 3 inches, minimum over the board joints. Make sure that a minimum of 1 inch of spray covers each side of the joint. Fasteners and washers along the board joints should also be completely covered with liquid spray flashing.
6. For rough openings apply liquid spray flashing a minimum of 3 inches onto the sheathing face, completely covering the sheathing board edge. In turn extend spray a minimum of 3 inches back onto the rough opening substrate. It is recommended to cover a distance back onto the rough opening equal to what is covered by traditional flashing materials.
7. For penetrations through the rigid insulation or substrate apply the liquid spray flashing a minimum of 2 inches onto the sheathing face and a minimum of 2 inches onto the penetration substrate or primary flashing substrate.
8. Use wet mil thickness gauge to ensure proper installation thickness. A paint brush can be used to even out product application thickness. If product is consistently below minimum thickness spray another pass to achieve proper thickness requirements.

- C. Spray liquid flashing typically cures to touch within 1 to 4 hours after application. Depending on humidity, temperature, sun exposure, and wind direction this time can be longer. Application should be dry to an approximate 30 mil thickness when completely

3.6 PROTECTION

- A. Protect installed products until finish materials can be applied.
1. Protect sheathing/insulation work from exposure to moisture damage and deterioration, primarily by prompt installation of the roofing, sheet metal and waterproofing work.

- B. Cover the top and edges of unfinished roof panel work to protect it from the weather and to prevent accumulation of water in the cores of the panels.
 - 1. Do not leave panels exposed to moisture. Wet panels shall be removed prior to application of roof covering.

END OF SECTION 06 16 00

SECTION 06 17 53 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Wood roof trusses.
 - 2. Wood girder trusses.
 - 3. Wood truss bracing.
 - 4. Metal truss accessories.
- B. Related Sections include the following:
 - 1. Division 06 Section "Sheathing" for roof sheathing and subflooring.

1.2 DEFINITIONS

- A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.
- B. TPI: Truss Plate Institute, Inc.
- C. Lumber grading agencies, and the abbreviation used to reference them, include the following:
 - 1. NELMA – Northeastern Lumber Manufacturers Association
 - 2. NLGA – National Lumber Grades Authority
 - 3. SPIB – Southern Pine Inspection Bureau
 - 4. WCLIB – West Coast Lumber Inspection Bureau
 - 5. WWPA – Western Wood Products Association

1.3 COORDINATION

- A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

1.4 ACTION SUBMITTALS

- A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.
 - 1. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.
 - 2. Qualification Data: For metal-plate manufacturer, professional engineer, and fabricator.
 - 3. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer. Show fabrication and installation details for trusses.
 - 1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
 - 2. Indicate sizes, stress grades, and species of lumber.
 - 3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
 - 4. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
 - 5. Show splice details and bearing details.
- C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
 - 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator's Qualifications: Provide trusses by a firm which has a record of successfully fabricating trusses similar to type indicated and which complies with the following requirements for quality control:
 - 1. Fabricator practices a quality control program, which complies with, or is comparable to, one published in TPI "Quality Standards for Metal Plate Connected Wood Trusses" and which involves inspection by an independent inspection and testing agency acceptable to A/E and authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations of TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
 - 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
 - 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 - 3. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements" to design metal-plate-connected wood trusses.
- B. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
 - 1. Design Loads: As indicated.
 - 2. Maximum Deflection Under Design Loads:
 - a. Roof Trusses: Vertical deflection of 1/240 of span unless otherwise noted.
- C. Comply with applicable requirements and recommendations of the following publications:
 - 1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
 - 2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
 - 3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.

2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 3. Provide dressed lumber, S4S.
 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Grade and Species: For truss chord and web members, provide dimension lumber of any species, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."
- C. Minimum Specific Gravity for Top Chords: 0.50.
- D. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Division 06 Section "Rough Carpentry."

2.3 METAL CONNECTOR PLATES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Alpine Engineered Products, Inc.
 2. Cherokee Metal Products, Inc.; Masengill Machinery Company.
 3. Eagle Metal Products.
 4. MiTek Industries, Inc.; a subsidiary of Berkshire Hathaway Inc.
- B. Fabricate connector plates to comply with TPI 1.
- C. Hot-Dip Galvanized Steel Sheet: ASTM A 653; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.
1. Use for interior locations, unless otherwise indicated.

2.4 FASTENERS

- A. Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
 2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153 or Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.

2.5 METAL TRUSS ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cleveland Steel Specialty Co.
 2. Phoenix Metal Products, Inc.
 3. Simpson Strong-Tie Co., Inc.
 4. USP Structural Connectors.
- B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

- C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 coating designation.
 - 1. Use for interior locations, unless otherwise noted.
- D. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A653; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 - 1. Use for wood-preservative-treated lumber and where indicated.
- E. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fastens to one side of truss, top plates, and side of stud below.
- F. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of truss and fastens to both sides of truss, top plates, and one side of stud below.
- G. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/2 inches wide by 0.062 inch thick. Tie fits over top of truss and fastens to both sides of truss, inside face of top plates, and both sides of stud below.
- H. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches wide by 0.050 inch thick. Clip is fastened to truss through slotted holes to allow for truss deflection.
- I. Floor Truss Hangers: U-shaped hangers, full depth of floor truss, with 1-3/4-inch- long seat; formed from metal strap 0.062 inch thick with tabs bent to extend over and be fastened to supporting member.
- J. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches wide by 1 inch deep by 0.040 inch thick, made to fit between 2 adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.
- K. Drag Strut Connectors: Angle clip with one leg extended for fastening to the side of girder truss.
 - 1. Angle clip is 3 by 3 by 0.179 by 8 inches with extended leg 8 inches long. Connector has galvanized finish.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

2.7 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in truss accessories according to manufacturer's fastening schedules and written instructions.
- H. Securely connect each truss ply required for forming built-up girder trusses.
 - 1. Anchor trusses to girder trusses as indicated.
- I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with Division 06 Section "Rough Carpentry."
 - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- J. Install wood trusses within installation tolerances in TPI 1.
- K. Do not cut or remove truss members.
- L. Replace wood trusses that are damaged or do not meet requirements.
 - 1. Do not alter trusses in field.
 - 2. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by A/E.

3.2 REPAIRS AND PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- C. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.
 - 1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections to verify that temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

END OF SECTION 06 17 53

SECTION 06 41 16 – PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Custom plastic-laminate-faced cabinets including base, wall and tall cabinets.
 - a. Cabinets indicated to receive sinks shall be constructed to allow for installation of sinks of sizes indicated. Coordinate with Division 22 for sink sizes.
 - 2. Casework hardware and accessories.
 - 3. Solid surface countertops.
 - 4. Plastic-laminate countertops
 - 5. Quartz surfacing countertops.
 - 6. Wood furring, blocking, shims, and hanging strips for installing architectural wood cabinets, unless concealed within other construction before cabinet installation.
- B. Related Sections include the following:
 - 1. Division 06 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
 - 2. Division 07 Section "Joint Sealants".

1.2 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.
- B. Exposed Portions of Casework: Include surfaces visible when doors and drawers are closed. Bottoms of casework more than 4 feet above floor and tops less than 6 feet 6 inches above floor shall be considered as exposed. Visible members in open cases or behind glass doors also shall be considered as exposed portions. Any unit exterior side surface that is visible after installation.
- C. Semi-Exposed Portions of Casework: Includes those members behind opaque doors, such as shelves, divisions, interior faces of ends, case back, drawer sides, backs and bottoms, and back face of doors. Tops of casework 6 feet 6 inches or more above floor shall be considered semi-exposed.
- D. Concealed Portions of Casework: Include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

1.3 SYSTEM DESCRIPTION

- A. Accessibility Requirements: Millwork shall be provided to conform to the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.
- B. Performance Requirements
 - 1. Cabinet tops shall not deflect more than 1/4 inch, where indicated to receive loads.
 - a. Cabinets supporting TV/monitor shall be capable of supporting a 250 pound capacity, unless otherwise noted.
 - 2. Countertops shall not deflect more than 1/4 inch when a load of 100 pounds per linear foot is applied.
 - a. Unsupported countertop spans shall not exceed 48 inches and must be reinforced to prevent deflection in excess of 1/4 inch.

1.4 COORDINATION

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

1.5 ACTION SUBMITTALS

- A. Product Data: For panel products high-pressure decorative laminate adhesive for bonding plastic laminate solid-surfacing material cabinet hardware and accessories and finishing materials and processes.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for electrical switches and outlets plumbing fixtures faucets and other items installed in architectural woodwork.
- C. Samples for Verification:
 - 1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
 - 2. Solid-surfacing materials, 6 inches square.

1.6 QUALITY ASSURANCE

- A. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose product have a record of successful in-service performance.
- C. Physical Performance Characteristics for Solid Surface Material
 - 1. Flammability Test (flame spread and smoke developed)
 - a. Test Procedure: ASTM E84.
 - b. Rating: Class A.
 - 2. Food Zone Use
 - a. Test Procedure: NSF 51.
 - b. Rating: Pass
- D. Materials shall contain less than one percent asbestos by content.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 FIELD CONDITIONS

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

- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
 - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide product by the manufacturers specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural wood cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
 - 2. Grade: Custom.

2.3 MATERIALS

- A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
 - 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
 - 2. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
 - 2. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde or Grade M-2-Exterior Glue.
 - 3. Softwood Plywood: DOC PS 1, medium-density overlay.

- C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
 - 1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges. Match color and pattern of thermoset decorative panels.
- D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
- E. Quartz Surfacing: Material comprised of up to 93 percent crushed quartz aggregate combined with polymer resins and pigments and fabricated into slabs using vacuum vibro-compaction process.
 - 1. Manufacturer: Caesarstone U.S.A., Inc. or equal.
 - 2. Thickness: 3/4 inch, minimum.
 - 3. Identification: Labeled with batch number and manufacturer's imprinted identifying mark on back.
 - 4. Finish: Polished.
 - 5. Color: As indicated on List of Finishes."
- F. Solid-Surfacing Material: Homogeneous solid sheets of filled acrylic resin complying with ISSFA-2-01 (2002).
 - 1. Manufacturers: Subject to compliance with requirements, provide products listed in the "List of Finishes" on drawings.
 - a. Avonite, Inc.
 - b. E. I. du Pont de Nemours and Company.
 - c. Formica Corporation.
 - d. Samsung Chemicals (USA) Inc.; Cheil Industries Inc.
 - e. Wilsonart International; Div. of Premark International, Inc.
 - 2. Type: Standard type, unless Special Purpose type is indicated.
 - 3. Colors and Patterns: As indicated in "List of Finishes".

2.4 COLOR AND FINISH

- A. Thermoset Decorative Panel Colors, Patterns, and Finishes: As selected by A/E from casework manufacturer's full range
- B. Plastic-Laminate Colors, Patterns, and Finishes: As indicated in the "List of Finishes".
- C. PVC Edgebanding Color: As selected from casework manufacturer's full range.
 - 1. Colors of PVC leading edges:
 - a. Open Units: Match exterior plastic laminate color.
 - b. Horizontal and Vertical Front Cabinet Members: Match exposed plastic laminate color or as selected by A/E.
 - c. Semi-Exposed Locations: Match interior plastic laminate color.
 - d. Drawer and Door Fronts: As selected from colors to match plastic laminate, or as selected by A/E.

2.5 CABINET HARDWARE AND ACCESSORIES

- A. Hardware Standards: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- B. Butt Hinges: 2-3/4-inch, 5-knuckle steel hinges made from 0.095 inch thick metal with hospital tip, and as follows:
- C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
- D. Catches: Magnetic catches, BHMA A156.9, B03141, roller catches, BHMA A156.9, B03071, or ball friction catches, BHMA A156.9, B03013.

- E. Adjustable Shelf Supports: Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on 1-inch centers. Each shelf support has 2 integral support pins, to interface pre-drilled holes, and to prevent accidental rotation of support. Support also provides non-tip feature for shelving.
 - 1. Structural load to support 1200 lbs. without failure.
- F. Drawer Slides: BHMA A156.9, B05091.
 - 1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-overtravel-extension type; zinc-plated steel ball-bearing slides.
 - 2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide.
 - 3. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches high or 24 inches wide.
 - 4. Pencil Drawer Slides: Grade 1; for drawers not more than 3 inches high and 24 inches wide.
- G. Drawer and Hinged Door Locks:
 - 1. Cylindrical (cam) or mortise type, 5-pin tumbler, brass with chrome-plated finish, and complying with BHMA A156.11, Grade 1.
 - 2. Cabinets to be keyed alike per room, each room keyed differently and master keyed, unless noted otherwise on drawings.
 - a. Provide four keys per room and 6 master keys.
 - 3. Provide locks on all doors and drawers.
- H. Door and Drawer Silencers: BHMA A156.16, L03011.
- I. Grommets for Cable Passage through Countertops: 3-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
- J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- L. Leveling Guides: Threaded hydraulically operated glide with silicone putty.
- M. Wire Management: Fabricate components as indicated on the Drawings.
 - 1. Contractor's Option: Provide prefabricated metal or fiberglass channel / cable tray, in lieu of plastic laminate tray, consisting of a one-piece solid bottom-channel section, complying with NEMA VE1 or NEMA FG1, and UL568. Sizes and configurations shall be no less than that indicated. Subject to compliance with requirements, provide products from one of the following manufacturers:
 - a. Chalfant Cable Tray, Cleveland, Ohio
 - b. GS Metals Corp., Pinckneyville, Illinois
 - c. MP Huskey Corp., Greenville, South Carolina
 - d. P-W Industries, Atlanta, Georgia
 - e. T.J. Cope, Collegeville, Pennsylvania
 - f. Wiremold Co., West Hartford, Connecticut
 - g. Thomas & Butts Corp., Memphis, Tennessee
- N. Other accessories as indicated on the Casework Schedule.

2.6 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

2.7 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Unless indicated otherwise, ease edges as follows:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch radius.
 - 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch radius.
- D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of openings in countertops with a coat of varnish.

2.8 PLASTIC-LAMINATE CABINETS

- A. AWI Type of Cabinet Construction: Flush overlay.
- B. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 - 1. Horizontal Surfaces Other Than Tops: Grade HGS.
 - 2. Vertical Surfaces: Grade HGS or VGS.
 - 3. Edges: 0.018-inch and PVC edge banding 3mm thick, through-door in satin finish matching laminate in color and pattern, as indicated.
- C. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS, High-pressure decorative laminate, Grade CLS, or Thermoset decorative panels.
 - a. Edges of Plastic-Laminate Shelves:
 - 1) Impact resistant PVC edge-banding, 1mm thick, through-color in satin finish.
 - 2) Unless otherwise indicated, provide specified edge-banding on all semi-exposed edges.
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS or CLS.
 - 2. Drawer Sides and Backs: Solid-hardwood lumber or thermoset decorative panels.
 - 3. Drawer Bottoms: Hardwood plywood or thermoset decorative panels.
- D. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

2.9 CABINET CONSTRUCTION

- A. Plastic-Laminate-Faced Cabinet Construction: As required by referenced quality standard, but not less than the following:
1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semiexposed surfaces, unless otherwise noted or as required to meet "Performance Requirements".
 2. Shelves:
 - a. Exposed Locations: 1 inch thick, vertical grade plastic laminate both sides. Color to match cabinet exterior plastic laminate or as selected by A/E.
 - b. Semi-exposed locations: 1 inch thick, thermoset decorative panels both sides.
 - c. Front and back leading edges shall be edged with flat 1mm thick impact-resistant PVC edging to match shelf color.
 - d. Number of adjustable shelves provided, unless indicated otherwise on the Drawings or on the Schedule
 - 1) Tall cabinets
3 up to 60 inches 5 up to 84 inches
4 up to 72 inches 6 up to 96 inches
 - 2) Base cabinets
1 up to 36 inches
 - 3) Wall hung cabinets
1 up to 24 inches 3 up to 42 inches
2 up to 36 inches
 3. Backs of Cabinets: 1/4 - 1/2-inch particleboard, plastic-laminate faced on exposed surfaces, thermally fused laminate (TFL) panels on semiexposed surfaces.
 4. Drawer Fronts: 3/4-inch particleboard, plastic-laminate faced to match doors.
 5. Drawer Sides, Backs, and Bottoms:
 - a. Constructed of minimum 1/2-inch particleboard, plywood, hardwood lumber, or high-density fiber board; glued and doweled or dovetail jointed; surfaced with vertical grade laminate or melamine of balanced construction. Bottoms constructed of minimum 1/4-inch tempered hardboard, surfaced to match drawer sides, inset and glued to four sides. Reinforce bottoms on wide drawers with front to back inset stiffeners, 1 at 24 inch wide drawers, 2 at 36 inch and 4 at 48 inch; glue, fasten, and seal perimeter with hot melt adhesive.
 - 1) Drawers:
 - a) Sides, back and sub front shall be particleboard, 1/2-inch thick, laminated with vertical grade laminate or melamine of balanced construction. The back and sub front shall be doweled and glued into the sides. Dowels shall be fluted, with chamfered ends and a minimum diameter of 8mm.
 - b) Drawer bottom shall be particleboard, 1/2-inch thick, laminated with vertical grade laminate or melamine of balanced construction, screwed directly to the bottom edges of the drawer box. Drawer bottom less than 1/2-inch thick will not be permitted.
 - c) Paper storage drawers shall be constructed similar except retaining hood shall be included at the rear of each drawer.
 6. File Drawers: Construct as specified above. File drawers shall have front-to-back and side-to-side hanger file capability with hanger channel for letter size files integral with file drawer sides. 3/16 inch by 1/2-inch removable steel channel to span side-to-side for legal size hanging files.
 7. Doors: 3/4-inch particleboard or MDF, plastic-laminate faced may be provided as fabricator's option to wood drawers.
 8. Provide stud framing chase walls with panels at specialty fabrications, desks, and plastic-laminate clad assemblies.
 - a. Panels shall be removable where indicated.
- B. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As selected by A/E.

2.10 COUNTERTOPS

- A. Countertops, General: Provide smooth, clean exposed tops and edges in uniform plane free of defects. Provide front and end overhang of 1 inch over base cabinets.
 - 1. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 2. Shop cut openings to maximum extent possible to receive fixtures and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings.
 - a. For plastic-laminate clad countertops: Sand edges of cutouts to remove splinters and burrs. Seal edges of openings in countertops with a coat of varnish.
- B. Plastic-Laminate Tops: Plastic-laminate sheet, shop bonded to both sides of 1-1/8-inch plywood or particleboard. Sand surfaces to which plastic laminate is to be bonded.
 - 1. Plastic Laminate for Flat Tops: Grade HGS, unless otherwise noted.
 - 2. Plastic Laminate for Backing: Grade BKL.
 - 3. Provide 3-mm PVC edging on front edge of top, on top edges of backsplashes and end splashes, and on ends of tops and splashes.
 - 4. Backsplashes 4-inch high scribable, square set; color matching, and mechanically attached, with endsplashes.
 - a. Provide at locations where countertops abut walls and where otherwise indicated.
 - b. Backsplashes shall have a moisture-resistant core.
 - 5. Use exterior plywood or exterior glue particleboard for countertops containing sinks.
 - 6. Utilize same construction for plastic laminate locker tops/shelves.
- C. Quartz countertops: 3/4 inch minimum quartz surfacing slabs in configuration indicated on Drawings.
 - 1. Core Material: Particleboard made with exterior glue, 1 inch – 1-1/8 inch either fully supported or in framework configuration recommended by fabricator
 - 2. Edges: Beveled.
 - 3. Outside Corners: Square.
 - 4. Mounting Adhesives: Provide structural-grade silicone or epoxy adhesives as recommended by manufacturer for application and condition of use.
 - 5. Fabricate tops in one piece to greatest extent possible. Joint type where required shall be bonded.
 - 6. Provide shop-applied edges of same material and thickness.
 - 7. Provide backsplash and endsplash in solid 3/4 inch material, field applied.
 - 8. Color: As selected from manufacturer's standards or as listed in the "List of Finishes".
- D. Solid-Surfacing Tops:
 - 1. Solid-Surfacing-Material Thickness: 1/2 inch.
 - 2. Core Material: Particleboard made with exterior glue, 1 inch – 1-1/8 inch either fully supported or in framework configuration recommended by fabricator
 - 3. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
 - a. Refer to "List of Finishes".
 - 4. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
 - a. Fabricate tops with shop-applied edges of materials and configuration indicated.
 - b. Fabricate tops with loose backsplashes for field application.

2.11 SPECIALTY ITEMS

- A. Support Members: Furniture grade, epoxy powder coated steel or aluminum, of size and configuration as detailed, indicated or required by "performance standards". Exposed welds shall be ground smooth.

1. Countertop Support Brackets: Wall mounted, heavy duty, welded aluminum brackets for support of countertops and work surfaces.
 - a. Extruded aluminum complying with ASTM B221, 6063-T5 alloy.
 - b. Finish: Clear Anodized.
 - c. Size: As required by countertop width to support.
 - d. Product: As indicated on Drawings as manufactured by Rangine Corporation (Rakks).
2. Countertop Support: Wall mounted, heavy duty, steel support brace.
 - a. Steel, ASTM A36 or JIS G3131 SPHC Steel, 12 gauge.
 - b. Provide holes in bracket for cable passage.
 - c. Size: As required by countertop width to support.
 - d. Finish: Manufacturer's standard powder coat paint finish.
 - e. Product: As indicated on Drawings as manufactured by Rangine Corporation (Rakks).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas for not less than 72 hours.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install cabinets and woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble cabinets and woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. Anchor cabinets and woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- D. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Fasten cabinets to masonry or framing, wood blocking, or reinforcements in walls and partitions with fasteners spaced 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.
 1. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 24 inches o.c. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.
- E. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in walls or partitions. Align similar adjoining doors to a tolerance of 1/16 inch.
 1. Fasten through back, near top and bottom, at ends, and not more than 16 inches o.c.
 2. Use toggle bolts at hollow masonry.
 3. Use expansion anchors at solid masonry.
 4. Use No. 10 wafer-head screws sized for 1-inch penetration at wood hanging strips.
 5. Use No. 10 wafer-head screws sized for 1-inch penetration into wood framing or blocking at wood-framed partitions.
 6. Use No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish or toggle bolts through metal backing or metal framing behind wall finish at metal-framed partitions.
 7. Use toggle bolts at plaster on metal lath.

- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 2. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 3. Maintain veneer sequence matching of cabinets with transparent finish.
 4. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- G. Countertops: Install countertops to comply with same grade as item to be installed. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 2. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
 - a. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
 3. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 4. Scribe tops and backsplashes to walls and other adjoining vertical surfaces.
 5. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
 6. Caulk space between backsplash and wall with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.
 7. Where indicated, remove existing countertops and prepare surfaces to receive new countertop assembly.
- H. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.
- I. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 ADJUSTING AND CLEANING

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

END OF SECTION 06 41 13

SECTION 06 61 16 - SOLID SURFACE FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Solid Surface Fabrications (SSF) including, but not limited to the following:
 - 1. Window sills

1.2 REFERENCES

- A. Applicable Standards: Standards of the following, as referenced herein:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing and Materials (ASTM)
 - 3. National Electrical Manufacturers Association (NEMA)

1.3 ACTION SUBMITTALS

- A. Sample for Initial Selection: Manufacturers color charts.

1.4 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 - 1. Maintenance Data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project closeout documents.
 - 2. Warranty: Special warranty as specified in this Section.

1.5 QUALITY ASSURANCE

- A. Allowable tolerance:
 - 1. Variation in component size: +/- 1/8 inch.
 - 2. Location of openings: +/- 1/8 inch from indicated location.
- B. Physical Performance Characteristics
 - 1. Flammability Test (flame spread and smoke developed)
 - a. Test Procedure: NFPA 255 or UL 723.
 - b. Rating: Class A.
 - 2. Food Zone Use
 - a. Test Procedure: NSF 51.
 - b. Rating: Pass
- C. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery no components to the project site until areas are ready for installation. Store components indoors prior to installation.
- B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.8 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

1.9 WARRANTY

- A. Provide manufacturer's warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
- B. Manufacturer's Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOLID POLYMER FABRICATIONS

- A. Manufacturers: Subject to compliance with requirements, provide one of the following:
 - 1. ABA Industries
 - 2. Avonite, Surfaces; a brand of Aristech Surfaces LLC
 - 3. E.I. du Pont de Nemours and Company.
 - 4. Formica Corp.
 - 5. LG Hansys, Ltd.
 - 6. Meganite Inc.; a division of the Pyrochem Group.
 - 7. Samsung Chemicals (USA), Inc.; Cheil Industries Inc.
 - 8. Swan Corporation (The).
 - 9. Transolid, Inc.
 - 10. Wilsonart International; Div. of Premark International, Inc.
 - 11. Durasein Solid Surface; a brand of Relang International, LLC
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 MATERIALS

- A. Material: Homogeneous solid sheets of filled acrylic resin complying with ANSI Z124.3 or ANSI Z124.6 or ISFA 2-01.
 - 1. Superficial damage to a depth of 0.010 inches shall be repairable by sanding and polishing.
 - 2. Windowsills: (SSF) 1/2 inch thick, adhesively joined with inconspicuous seams; edge details as indicated on the A/E's Drawings.
- B. Color: As selected by A/E from manufacturer's standard.

2.3 INSTALLATION ACCESSORIES

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Joint Adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond.
- C. Sealant: Manufacturer's standard mildew-resistant, NSF 51 - compliant silicone sealant in color matching or clear formulations.
 - 1. Sealant for Countertops: Comply with applicable requirements in Division 07 Section "Joint Sealants".

2.4 FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards".
 - 1. Grade: Custom.
 - 2. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with final shop drawings and manufacturers requirements.
- B. Provide holes and cutouts for plumbing and bath accessories as indicated on the drawings.
- C. Finish: All surfaces shall have uniform finish.
 - 1. Matte, with a gloss rating of 5 - 20.
- D. Configuration:
 - 1. Front: Straight, slightly eased at top.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates upon which solid surfacing will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Coordinate with responsible entity to correct unsatisfactory conditions.
- C. Commencement of work by installer is acceptance of substrate conditions.

3.2 INSTALLATION

- A. Install components level to a tolerance of 1/8 inch 8 feet, 1/4 inch maximum. Do not exceed 1/64 inch difference between planes of adjacent units.
- B. Install components plumb and level, in accordance with final shop drawings and product installation details.
 - 1. Provide product in the largest pieces available.
 - 2. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
 - a. Exposed joints/seams shall not be allowed.
 - 3. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the scam with the strip being the same thickness as the top.
 - 4. Cut and finish component edges with clean, sharp returns.
 - 5. Route radii and contours to template.
 - 6. Anchor securely to base cabinets or other supports.
 - 7. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
 - 8. Carefully dress joints smooth, remove surface scratches and clean entire surface.
 - 9. Install countertops with no more than 1/8 inch sag, bow or other variation from a straight line.
- C. Keep components and hands clean during installation. Remove adhesives, sealants and other stains.

3.3 REPAIR/CLEANING/PROTECTION

- A. Repair minor imperfections and cracked seams and replace sections of severely damaged surfaces in accordance with manufacturer's recommendations.
- B. Clean surfaces in accordance with manufacturer's instructions.

- C. Cover horizontal surfaces with heavy paper or cardboard to protect from damage until date of Substantial Completion or acceptance by Owner.
- D. Fabricator/Installer is to review maintenance procedures and the warranty with the Owner upon completion of project.

END OF SECTION 06 61 16

07

DIVISION

THERMAL AND MOISTURE PROTECTION

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber blanket insulation.
 - 2. Mineral-wool blanket insulation.
 - 3. Loose-fill insulation.
 - 4. Miscellaneous spray polyurethane foam insulation.
- B. Related Sections:
 - 1. Division 03 Section "Cast-in-Place Concrete" for underslab vapor barriers.
 - 2. Division 06 Section "Sheathing" for foam-plastic board sheathing over wood or steel framing, including both roof and wall sheathing.
 - 3. Division 07 Section "Joint Firestopping" for insulation installed as part of a perimeter fire-resistive joint system.
 - 4. Division 09 Section(s) "Gypsum Board Assemblies" for sound attenuation blanket used as acoustic insulation.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate with other thermal assemblies and air barrier assemblies to provide a complete thermal envelope.
 - 1. Fill gaps around penetrations to prevent gaps in thermal envelope.
- B. Sequence: Sequence installation of insulation so materials can be installed for optimum performance.
- C. Sequence and coordinate application of sprayed-on insulation with other related Work specified in other Sections to comply with the following requirements:
 - 1. Ensure that insulating material is installed prior to installation of enclosing or concealing work, with sufficient time allowed for observation, testing, and correction of defective insulation work.
 - 2. Plumbing, wiring (including telephone and other low-voltage work) shall be completely roughed in stud cavities before beginning insulation work.
- D. Coordinate installation of sprayed insulation with other Work in order to minimize the need for other trades to cut or remove insulation.
 - 1. Cutting and patching after installation of sprayed-on insulation shall be in accordance with Division 01 Section "Cutting and Patching".
- E. Ducts, piping, conduit, or other suspended equipment that interfere with the uniform application of the insulation material shall be positioned after the application of the sprayed insulation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Product Test Reports: Upon request, submit fire and thermal test reports performed by a qualified testing agency.
 - a. Spray-Foam: Submit the technical data sheet from the manufacturer showing the test results from the ASTM E84 (Surface Burning Characteristics).

5. Evaluation Reports: Upon request, submit the following:
 - a. For intumescent coating, documentation from an independent testing laboratory that demonstrates that it satisfies the Acceptance criteria for Spray-Applied Foam Plastic Insulation (AC377) to serve as the code-mandated thermal barrier over polyurethane foam.
 - b. For spray-applied polyurethane foam-plastic insulation, from ICC-ES or other third party certifiers approved by authorities with jurisdiction.

1.4 QUALITY ASSURANCE

- A. Polyurethane Foam Installer Qualifications: An authorized representative who is trained and approved by manufacturer or certified by the Spray Polyurethane Foam Alliance through the SPFA-PCP as an insulation installer or higher certification.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Materials to be delivered to the site in original labeled and unopened packages, clearly labeled with manufacturer's name, product identifications, safety information, and batch or lot numbers, where appropriate. Where materials are covered by a referenced specification, the labels shall bear the specification number, type, and class, as applicable.
 1. Material shall be stored in a safe manner and where the temperatures are in the limits specified by the material manufacturer.
- B. 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.
 1. Bonding adhesives must be kept from freezing at all times.

1.6 FIELD CONDITIONS

- A. Environmental Conditions: Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
 1. Do not install sprayed-on insulation when ambient or substrate temperatures may fall below 40 degrees F or rise above 85 degrees during the application and drying processes.
 2. Ventilate the sprayed insulation by means of natural or forced air circulation during and after application until it dries thoroughly.
 - a. In enclosed areas, ventilation shall not be less than 4 complete air changes per hour.
 3. Protect adjacent surfaces, windows, equipment, and site areas from damage of overspray.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Products: Subject to compliance with requirements, provide one of the products specified.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Plenum Rating: Provide glass or slag-wool-fiber/rock-wool-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
 - 1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm air velocity.
 - 2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with *Chaetomium globosum* on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.
- B. Reference Standards:
 - 1. NFPA: Foam plastics left exposed to the interior occupied space must be covered by a thermal barrier or show compliance to NFPA 286 for flame spread classifications for specific materials or assemblies.
 - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- C. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than Class A, 25 and 450 when tested in accordance with ASTM E84.
- D. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from listing of another qualified testing agency.
- E. Labeling of Building Envelope Insulation: The rated-R-value shall be clearly identified by an identification mark applied by the manufacturer to each piece of building envelope insulation.
 - 1. When insulation does not have such an identification mark, the installer of such insulation shall provide a signed and dated certification for the installed insulation listing the type of insulation, the manufacturer, the rated R-value, and where appropriate, the installed thickness and the coverage area.
- F. Compliance with Manufacturer's Requirements: Insulation materials shall be installed in accordance with manufacturer's recommendations and in such a manner as to achieve rated R-value of insulation.

2.3 GLASS-FIBER BLANKET INSULATION

- A. Design Requirements: Products that have been manufactured fabricated and installed to the following criteria:
 - 1. Fire Test Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing protocol required to achieve UL Classified rated per UL 723 or by testing identical products according to ASTM E84 by a qualified testing agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CertainTeed Corporation
 - 2. Johns Manville
 - 3. Knauf Insulation
 - 4. Owens Corning

- C. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per UL 723 or ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Location: Walls.
- D. Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (water vapor permeance (ASTM E96): 0.5 perm)), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
 - 1. Location: Attic.
- E. Thermal Resistance
 - 1. R-value: 1.3 hr/ft²/f Btu
 - 2. RSI value: 2.3
 - 3. Thickness: As indicated.
- F. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.4 MINERAL-WOOL BLANKET INSULATION

- A. Design Requirements: Products that have been manufactured fabricated and installed to the following criteria:
 - 1. Fire Test Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing protocol required to achieve UL Classified rated per UL 723 or by testing identical products according to ASTM E84 by a qualified testing agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Thermafiber, an Owens Corning Co.
 - 2. Johns Manville
 - 3. Rockwool International
- C. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Thermal Resistance: R-Value; 3.8 per inch.
- D. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.5 LOOSE-FILL INSULATION

- A. Glass-Fiber Loose-Fill Insulation: ASTM C 764, Type I for pneumatic application or Type II for poured application; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
 - 1. Manufacturers
 - a. Knauf Insulation
 - b. CertainTeed
 - c. Owens Corning
 - d. Johns Manville
 - 2. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.
 - 3. Smoke-Developed Index: Not more than 5 when tested in accordance with ASTM E84.
 - 4. Location: Attic.

2.6 SPRAY POLYURETHANE FOAM INSULATION/THERMAL BARRIER

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bayer Material Science: Bayseal with one of the following thermal barriers:
 - a. Bayseal IC Intumescent Coating, Bayer
 - b. Flame Seal TB, Flame Seal Products
 - c. TPR² Fireshell BMS-TC, TPR² Corporation
 - d. DC 315, International Fireproof Technology
 2. Icynene Inc.: Icynene ProSeal Eco with the following thermal barrier:
 - a. DC 315, International Fireproof Technology
 3. Henry Company: Permax 2.0X with one of the following thermal barriers:
 - a. Flame Seal TB, Flame Seal Products
 - b. TPR² Fireshell BMS-TC, TPR² Corporation
 - c. DC 315, International Fireproofing Technology
 4. MBCC Group: Spraytite, Comfort Foam and Walltite with one of the following thermal barriers:
 - a. Aldocoat 800, Aldo Products
 - b. Noburn Plus, No-Burn Inc.
 - c. Spraycoat 1920, MBCC Group
 - d. Flame Seal TB, Specialty Products
 - e. DC 315, International Fireproof Technology
 5. Johns Manville: Corbond III with one of the following thermal barriers:
 - a. JM TC Thermal Barrier Intumescent Coating, Johns Manville.
 - b. Flame Seal TB, Flame Seal Products.
 - c. TPR² Fireshell BMS-TC, TPR² Corporation.
 - d. DC 315, International Fireproofing Technology.
 6. NCFI Polyurethane: InsulBloc with the following thermal barrier.
 - a. DC 315, International Fireproofing Technology.
 7. Huntsman Building Solutions: Heatlok HFO Pro with one of the following thermal barriers.
 - a. DC-315 Fireproof Paint
 - b. No-Burn Plus ThB
- B. Closed-Cell Polyurethane Foam Insulation with Thermal Barrier: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
1. Minimum density of 1.5 lb/cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F.
 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 3. Thermal Barrier: Provide an intumescent coating that has been qualified as the code-mandated thermal barrier over polyurethane foam by room corner tests conducted in accordance with NFPA 286 or UL 1715 as acceptable to authorities with jurisdiction.
- C. Primers: Provide primers as recommended by manufacturer for oily surfaces and galvanized steel like steel decks.

2.7 ACCESSORIES

- A. Wire Mesh Lath Support for Insulation: ASTM C1032
1. Material: Woven wire lath 1-1/2 inch hexagonal-shaped mesh with minimum 0.0510-inch diameter, galvanized-steel wire.
- B. Welded Wire Fabric: Cold drawn 10 gauge steel wire, electrically welded at the intersection of the transverse and longitudinal wires, which are both spaced 6 inches apart. Fabric shall conform to ASTM A 185 and be identified as 6 x 6-10 WWF.

- C. Sprayed Polyurethane Foam Sealant (Insulation for Miscellaneous Voids): 1 or 2 component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb./cu.ft. density; flame spread index of 25 or less according to ASTM E162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
 - 1. Provide single-component polyurethane sealant low expansion pressure specifically designed for sealing perimeter of openings.
 - 2. Use one-component foam for cracks or openings 1/4-inch to 2-inch wide. Use two-component foam sealant for gaps over 2-inches wide and for voids in hidden cavities.
- D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.
- E. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, if applicable, and demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with installer present, for compliance with requirements of Sections in which substrates and related work are specified and, for other conditions affecting performance.
- B. Examine sizes and conditions of voids to be sealed to establish correct thicknesses and installation of materials per manufacturer's recommendations.
- C. Verify that surfaces are ready to accept the work of this Section and penetrating elements are securely fixed, properly located and with the required space allowance between penetrants and openings.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.
- B. Clean substrate surfaces to remove moisture, dirt, dust, grease, oil, loose material, or other matter which may affect bond of foam sealant material. Ensure surfaces are dry before proceeding with installation.
 - 1. Remove incompatible materials that may affect bond.
 - 2. Install backing and damming materials for foam sealant to arrest material leakage and for support.
 - 3. Mask, using masking tape, where necessary to avoid spillage and over coating onto adjoining finish surfaces; remove stains on adjacent surfaces. Remove tape as soon as possible without disturbing foam sealant.
 - 4. Install primer on oily surfaces and galvanized steel.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- D. Spray Polyurethane Foam Insulation Priming: Prime Substrates where 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.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.
- F. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated.
 - 1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- G. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
 - a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
 - 6. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
- C. Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.
 - 1. For cellulosic-fiber loose-fill insulation, comply with CIMA's Bulletin #2, "Standard Practice for Installing Cellulose Insulation."
 - 2. Contractor's Option: Loose-fill insulation may be used in addition to a single layer of blanket insulation within attic to achieve total R-Value of insulation assembly.
 - a. Loose-fill insulation cannot completely replace blanket insulation in the attic assembly.

- D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Fill Insulation (Interior Assemblies): Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
 2. Spray Polyurethane Insulation or Foam Sealant (Exterior Walls): Apply according to manufacturer's written instructions.
 - a. Apply sealants within recommended application temperature ranges. Consult manufacturer when sealants cannot be applied within recommended ranges.
 - 1) In low humidity, mist area with water to aid cure of one-component sealant.
 - b. Provide continuity of thermal barrier by sealing the following areas within the construction and construction assemblies. Note that these areas are typical in nature and do not limit the application of these products to these noted areas, but any and all details within the construction that present similar characteristics should receive similar applications.
 - 1) Opening head, jamb, and sill areas at cavity wall.
 - 2) Roof/Wall Junctions: Inspect roof/wall perimeter for thermal gaps in areas such as the fluted deck itself, truss and structural beam penetrations above and below the top of the wall, open joints, and conduit and pipe penetrations.

3.5 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 07 21 00

SECTION 07 27 26.02 – VAPOR-PERMEABLE, FLUID-APPLIED MEMBRANE AIR BARRIER

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section includes the following:
 - 1. Materials and installation methods for a vapor-permeable, fluid-applied membrane air water resistive barrier system located in the non-accessible part of the wall.
 - 2. Materials and installation to bridge and seal the following air leakage pathways and gaps:
 - a. Connections of the walls to the roof air barrier.
 - b. Connections of the walls to the foundations.
 - c. Expansion joints.
 - d. Openings and penetrations of window frames, storefront, curtain wall.
 - e. Barrier other envelope systems.
 - f. Door frames.
 - g. Piping, conduit, duct and similar penetrations.
 - h. Masonry ties, screws, bolts and similar penetrations.
 - i. All other air leakage pathways in the building envelope.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for coordination with underslab vapor barriers.
 - 2. Division 04 Section "Unit Masonry" for embedded flashings (through-wall).
 - 3. Division 06 Section "Sheathing" for wall sheathings, wall sheathing joint-and-penetration treatments, building paper, and building wraps.
 - 4. Division 07 Roofing Sections for coordination with roof air and vapor barriers.
 - 5. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashings.
 - 6. Division 07 Section "Joint Sealants" for joint-sealant materials and installation.

1.2 DEFINITIONS

- A. ABAA: Air Barrier Association of America.
- B. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- C. Air Barrier Accessory: A transitional component of the air barrier that provides continuity.
- D. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.
- E. ICC-ES AC 212: Acceptance criteria for water resistive coatings used as water resistive barriers over exterior sheathing, published by International Code Council Evaluation Services.
- F. Vapor-Permeable, Fluid-Applied Water Resistive Barriers: Membrane exhibiting water vapor transmission properties according to Grade D of ICC-ES AC 212. Grade D membrane exhibits minimum 5 perms when tested in accordance with ASTM E 96 B (water method – unmodified).

1.3 PREINSTALLATION MEETINGS

- A. Pre-Installation Meeting: Conduct meeting at Project site.
 - 1. Preconstruction Meeting: Convene a minimum of two weeks prior to commencing Work of this Section. Agenda shall include, at a minimum, construction of mock-up, sequence of construction, coordination with substrate preparation, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and special details of construction. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.

2. Review air-barrier requirements and installation, special details, mockups, air leakage and bond testing, air barrier protection, and work scheduling that covers air barriers.

1.4 SEQUENCING

- A. Coordination of Trades:
 1. Applicator shall evaluate adjacent materials such as windows, doors, etc. for conformance to project details.
 2. General Contractor shall make provision for installation of air seals between the primary air barrier and other wall components (penetrations, etc.) in order to maintain continuity of an air barrier system.
 3. Applicator shall provide protection of rough openings before installing windows, doors, and other penetrations through the wall.

1.5 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, and manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.
 1. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.
 2. Include statement that materials are compatible with adjacent materials proposed for use.

1.6 QUALITY ASSURANCE

- A. Air Barrier Subcontractor Qualifications: Certified or approved applicator of Manufacturer's Product, included record of attendance at Manufacturer's training programs by the employees of the installing Contractor.
- B. Manufacturer: Obtain primary materials from a single manufacturer regularly engaged in manufacturing specified air barrier. Obtain secondary materials from a source acceptable to the primary materials manufacturer.
 1. Manufacturer shall provide products approved as Vapor-Permeable Fluid-Applied Membrane Air Barrier by the Air Barrier Association of America and be listed on the ABAA website.
 2. Manufacturer's Technical Representative shall be present at the job site to assist with the training of installers, observation of the substrate prior to application, observation at intervals of the construction and at completion of work.
 - a. Attend pre-installation conference and review mock-up wall construction.
 - b. Visit project site prior to application to observe with the applicator the substrate and substrate preparation.
 - c. Inspect the progress of work at 50% completion including testing of the material thickness and review of detailing.
 - d. Inspect the progress of work at 95% completion.
 - e. Provide written report of all site visits to the A/E and CM.
- C. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds for the specific authority having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.
- B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer. Protect stored materials from direct sunlight. Remove and replace liquid materials that cannot be applied within their stated shelf life.

- C. Avoid spillage. Immediately notify Owner and A/E if spillage occurs and start clean up procedures.
- D. Clean spills and leave area as it was prior to spill.

1.8 FIELD CONDITIONS

- A. Temperature: Install air and vapor barrier within range of ambient and substrate temperatures recommended by air and vapor barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
- B. Field Conditions: Do not install air and vapor barrier in snow, rain, fog, or mist without temporary protection and supplemental heat as required. Do not install air and vapor barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer. Apply membrane to a surface dry substrate, or in accordance with manufacturer's recommendations.
- C. Sequencing. Do not install air barrier material before the roof assembly has been sufficiently installed to prevent a buildup of water in the interior of the building.
- D. Compatibility. Do not allow air barrier materials to come in contact with chemically incompatible materials.
- E. Ultra-Violet Exposure. Do not expose air barrier materials to sunlight longer than as recommended by the material manufacturer.

1.9 WARRANTY

- A. Material Warranty: Provide manufacturer's standard product warranty, for a minimum 2 years from date of Substantial Completion.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
- B. Installation Warranty: Provide air barrier subcontractor's 2-year warranty from date of Substantial Completion, including all components of the air and vapor barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Material Performance: Provide materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 in. water (1.57 psf) (0.02 L/m² at 75 Pa.) when tested according to ASTM E2178.
- B. Water Vapor Transmission: The water vapor transmission water method, (Procedure B) shall be determined in accordance with ASTM E96 and shall be declared by material manufacturer as follows:
 - 1. Water vapor transmission shall be a minimum of 35 g/(m² * 24h) (5 grains/(h*ft²*in Hg) = 5 perms) when tested in accordance with ASTM E96 B (water method – unmodified).

- C. Assembly Performance: Provide a continuous air and vapor barrier assembly that has an air leakage not to exceed 0.040 cubic feet per square foot per minute under a pressure differential of 0.3 in. water (1.57 psf) (0.20 L/ m² at 75 Pa.) when tested in accordance with ASTM E2357, and a vapor permeance of 1 perm (57 mg) or less when tested in accordance with ASTM E96 using the desiccant method. Assembly shall perform as a liquid drainage plane flashed to discharge condensation or water penetration to the exterior. Assembly shall accommodate movements of building materials by providing expansion and control joints as required, with accessory air and vapor seal materials at such locations, changes in substrate and perimeter conditions.
1. Assembly shall be capable of withstanding combined positive and negative design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure.
 2. Assembly shall not displace adjacent materials under full load.
 3. Assembly shall be joined in an airtight and flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations and creep, and anticipated movement.
- D. Connections to Adjacent Materials: Provide connections to prevent air leakage and vapor migration at the following locations.
1. Foundation and walls, including penetrations, ties and anchors.
 2. Walls, windows, curtain walls, storefronts, louvers or doors.
 3. Different wall assemblies, and fixed openings within those assemblies.
 4. Wall and roof connections and penetrations.
 5. Floors over unconditioned space.
 6. Walls, floor and roof across construction, control and expansion joints.
 7. Walls, floors and roof to utility, pipe and duct penetrations.
 8. Expansion joints.
 9. All other leakage pathways in the building envelope.
- E. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- F. UV Resistance: Can be exposed to sunlight for 180 days according to manufacturer's written instructions.
- G. Application Temperature: 25 deg. to 120 deg.
- H. Damp Surface Tolerant: Can be applied to damp-to-touch surfaces that are free of liquid water.

2.2 MATERIALS, GENERAL

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

2.3 VAPOR-PERMEABLE, FLUID-APPLIED AIR BARRIER

- A. Vapor-Permeable, Fluid-Applied Membrane Air Barrier: Use regular, high temperature or low-temperature formulation depending on site conditions, within temperature ranges specified by manufacturer. Subject to compliance with requirements, provide one of the following:
1. Material: Tyvek Fluid Applied WB at 25 mils thick (wet), 25 mils thick (dry) by DuPont Building Innovations www.Weatherization.Tyvek.com:
 - a. Air Barrier Material Properties:
 - 1) Air permeance for this material has been tested and reported as being 0.0002 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0002 cfm/ft² @ 1.57 psf), at 25 mils (dry), when tested in accordance with ASTM E2178 (unmodified).

- 2) Water vapor permeance for this material has been tested and reported as being 25 grains of water vapor passing through each square foot of area per hour per inch Hg of water vapor pressure differential (25 perms) when tested in accordance with ASTM E96 B (water method – unmodified). Corresponding water vapor transmission is 173 grams of water vapor passing through each square meter of area per day (173 g/(m²*24h)).
- b. Air Barrier Accessory Materials
 - 1) Fluid-Applied Air Barrier Membrane: DuPont™ Tyvek® Fluid Applied WB - A vapor permeable, low VOC, single-component elastomeric polymer membrane. Spray or roller applied in one coat at 25mils; low temperature, and damp surface application.
 - 2) Solvent Based Primer for Flashing, Transition Strip and Detail Membranes: 3M High Strength 90; Denso Butyl (used with self-adhered membranes only)
 - 3) Through-Wall Flashings or Shelf Angle Flashings: Refer to Division 04 Section "Unit Masonry".
 - 4) Sealants, Mastics, Adhesives and Tapes: DuPont™ Sealant for Tyvek®
 - 5) Fluid Applied System; DuPont™ Tyvek® Flashing and Joint Compound; fiberglass mesh tape
 - 6) Transition, Termination, and Detailing Membrane: DuPont™ StraightFlash™, or DuPont™ Tyvek® Flashing and Joint Compound (60mil)
 - 7) Penetrations & Termination Sealant: DuPont™ Sealant for Tyvek® Fluid Applied System
 - 8) Window Flashing Membrane: DuPont™ Tyvek® Fluid Applied Flashing and Joint Compound, or DuPont™ Tyvek® Fluid Applied Flashing – Brush Formulation, or DuPont™ StraightFlash™ with DuPont™ FlexWrap™
 - 9) Joint Treatment: None(≤ 1/16" gaps); (DuPont™ Tyvek® Flashing and Joint Compound(≤ 1/4" gaps); DuPont™ Tyvek® Flashing and Joint Compound w/ fiberglass mesh tape (≤ 1/2" gaps); DuPont™ StraightFlash™ (≤ 1" gaps)
2. Material: Perm-A-Barrier VPL 50RS, 20 mils thick (wet/dry) by GCP Applied Technologies, www.GCPAT.com:
 - a. Air Barrier Material Properties:
 - 1) Air permeance for this material has been tested and reported as being 0.0004 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0004 cfm/ft² @ 1.57 psf), at 69 mils (wet), when tested in accordance with ASTM E2178 (unmodified).
 - 2) Water Vapor Permeance: ASTM E96, Method B: Greater than 10 perms at 20 mil.
 - b. Air Barrier Accessory Materials:
 - 1) Transition Membrane: GCP Applied Technologies. Product shall meet GCP most current performance standards:
 - a) PERM-A-BARRIER; Detail Membrane, NPS Detail Membrane, Aluminum Flashing, Wall Flashing, and Liquid Flashing.
 - 2) Penetrations and Termination Sealant: Perm-a-Barrier Liquid Flashing manufactured by GCP Applied Technologies: Sealant for Details, Final Terminations.
 - 3) Sheathing Joint Sealant: PERM-A-BARRIER 5100.
 - 4) Through-Wall Flashings or Shelf Angle Flashings: Refer to Division 04 Section "Unit Masonry".
3. Material: Air Bloc All Weather STPE; Henry at 20 mils (wet/dry) www.henry.com:
 - a. Air Barrier Material Properties:
 - 1) Air permeance for this material has been tested and reported as being 0.00024 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.00024 cfm/ft² @ 1.57 psf), at 87 mils (wet) when tested in accordance with ASTM E2178 (unmodified).
 - 2) Water vapor permeance for this material has been tested and reported as being 2066 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential 36.12 US perms at 44 mils (dry) when tested in accordance with ASTM E96 (water method – unmodified).

- b. Air Barrier Accessory Materials:
 - 1) Flashings; choose from the following:
 - a) Liquid-applied flashing:
 - .1 Moisture-cure one component elastomeric liquid applied flashing using an STPE (Silyl-Terminated Polyether) polymer, having the following typical properties:
 - .a Basis of Design Product: Henry Air-Bloc LF® Liquid Applied Flashing.
 - .b Color: Blue.
 - b) Self-adhering flashing:
 - .1 Vapor impermeable, self-adhered water resistive air and vapor barrier consisting of an SBS rubberized asphalt compound, integrally laminated to a blue engineered thermoplastic film, having the following typical properties:
 - .a Basis of Design Product: Henry Blueskin® SA Self-Adhered Water Resistive Air Barrier.
 - .b Color: Blue.
 - 2) Primers for Self-Adhered Flashing:
 - a) Polymer emulsion-based primer for self-adhered membranes, and having the following typical properties:
 - .1 Basis-of-Design Product: Henry Aquatac™ Primer.
 - .2 Color: Aqua.
 - .3 Water based: Maximum VOC: 50 g/l.
 - 3) Sealants:
 - a) Moisture cure, medium modulus polymer modified sealant compound, having the following typical properties:
 - .1 Basis-of-Design Product: Henry 925 BES Sealant.
 - .2 Complies with Fed. Spec. TT-S-00230C, Type II, Class A.
 - .3 Complies with ASTM C920, Type S, Grade NS, Class 35.
 - 4) Thru-Wall Flashing:
 - a) Vapor impermeable, self-adhered water resistive air and vapor barrier consisting of an SBS rubberized asphalt compound, integrally laminated to a yellow engineered thermoplastic film, having the following typical properties:
 - .1 Basis-of-Design Product: Henry Blueskin TWF Self-Adhered Thru-Wall Flashing.
 - .2 Color: Yellow.
4. Material: Spray-N-Rod; Polyguard Airllok STPE WRB
 - a. Air Barrier Material Properties:
 - 1) Air permeance for this material has been tested and reported as being 0.000024 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot at 20 mils (dry) when tested in accordance with ASTM E2178 (unmodified).
 - 2) Water vapor permeance for this material has been tested and reported as being 857 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential 15 US perms at 20 mils (dry) when tested in accordance with ASTM E96 (water method – unmodified).
 - b. Air Barrier Accessory Materials:
 - 1) Flashing: Airllok® Flash-N-Roll is a single component, Silyl Terminated Polyether (STPE), 100 percent solid moisture-cured, elastomeric, roller-applied above-grade fluid flashing.
 - 2) Flashing: Airllok® STPE WRB Gun-N-Spread is a single component, Silyl Terminated Polyether (STPE), 100 percent solid moisture-cured, elastomeric gun and trowel applied above-grade fluid flashing.
 - 3) Flashing and Sealant Detail Sealant PW™ is a single component, Silyl Terminated Polyether (STPE), 100 percent solid moisture-cured, elastomeric tube and trowel applied joint filler, sealant and fluid flashing.

- 4) Flashing and Sealant Airllok® STPE WRB Detail-N-Joint is a single component, Silyl Terminated Polyether (STPE), 100 percent solid moisture-cured, elastomeric tube and trowel applied above grade fiber filled joint filler, sealant and transition fluid flashing.
 - 5) Flashing: Polyguard® Airllok® Sheet 400 NP is a 40-mil, laminated, modified-asphalt, self-adhesive membrane bonded to a cross-laminated polyethylene sheet and is used for wall flashing, through-wall flashing (TWF), joint flashing, and non-vapor permeable sheet air barrier. Use Airllok® Sheet 400 NP for ambient and substrate surface temperatures 25 deg. and rising. Airllok® Sheet 400 NP resists sunlight up to 30 days.
 - 6) Flashing: Polyguard® Airllok® Sheet UV 400 NP is a 40-mil, composite membrane, consisting of a foil/polyscrim, laminated to a layer of rubberized-asphalt and is used for wall flashing, through-wall flashing (TWF), and joint flashing, and non-vapor permeable sheet air barrier. Use Airllok® Sheet UV 400 NP for ambient and substrate surface temperatures 25 deg. and rising. Airllok® Sheet UV 400 NP resists sunlight up to 1 year.
 - 7) Flashing: Polyguard® Airllok® Sheet UV 400 NP is a 40-mil, laminated, modified-asphalt, self-adhesive membrane bonded to a cross-laminated polyethylene sheet with a top protective layer of aluminum and is used for wall flashing, through-wall flashing (TWF), and joint flashing, and non-vapor permeable sheet air barrier. Use Airllok® Sheet UV Ultra 400 NP for ambient and substrate surface temperatures 40 deg. and rising. Airllok® Sheet UV Ultra 400 NP resists sunlight up to 2 years.
 - 8) Flashing: Polyguard® Airllok® Sheet 200 BU/NP is a 28-mil, laminated, butyl compound, self-adhesive, non-permeable sheet membrane bonded to a cross-laminated polyethylene sheet and is used for wall flashing, through-wall flashing (TWF), joint flashing, and non-vapor permeable sheet air barrier. Use Airllok® Sheet 200 BU/NP for ambient and substrate surface temperatures 20 deg. and rising. Airllok® Sheet 200 BU/NP resists sunlight up to 30 days.
 - 9) Flashing: Polyguard® Airllok® Sheet UV 200 BU/NP is a 28-mil, laminated, butyl compound, self-adhesive, non-permeable sheet membrane bonded to a cross-laminated polyethylene sheet and is used for wall flashing, through-wall flashing (TWF), and joint flashing, and non-vapor permeable sheet air barrier. Use Airllok® Sheet UV 200 BU/NP for ambient and substrate surface temperatures 20 deg. and rising. Airllok® Sheet UV 200 BU/NP resists sunlight up to 1 year.
 - 10) Surface Primer Roller-Grade Adhesive:
 - a) Polyguard® 650 LT Liquid Adhesive: A rubber-based, tacky adhesive which is specifically formulated to provide excellent adhesion.
 - b) Polyguard® California Sealant: A rubber-based sealant which is specifically formulated to provide excellent adhesion. The VOC (Volatile Organic Compound) content meets the South Coast Air Quality Management District regulations established under the February 1, 1991 version of Rule 1168© (2) Adhesion and Sealant Applications, California Sealant is classified as an Architectural Sealant Primer Porous, with VOC of 527 g/L. Current SCAQMD regulations for this type sealant primer are 775 g/L.
 - 11) Spray Adhesive
 - a) Quick Grip Spray Adhesive: A Building Envelope, industrial-grade aerosolized adhesive in a portable spray system. It contains non chlorinated solvents, and offers an excellent alternative to methylene chloride-based products.
5. Material: Sopraseal LM 204 VP; Soprema:
- a. Air Barrier Material Properties:
 - 1) Air permeance for this material has been tested and reported as being 0.00097 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot at 40 mils (wet) when tested in accordance with ASTM E2178 (unmodified).

- 2) Water vapor permeance for this material has been tested and reported as being 857 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential 15.0 US perms at 20 mils (dry) when tested in accordance with ASTM E96 (water method – unmodified).
- b. Air Barrier Accessory Materials:
 - 1) Soprema Sopraseal Liquid Flashing; 100 percent solids, moisture curing polyether flashing material. 10.1 oz. cartridge or 20 oz. sausages.
 - 2) Soprema Sopraseal Stick 1100T; tri-laminate woven polyethylene film-surfaced, SBS self-adhesive flashing and transition membrane for rough openings and penetrations. 40 mil thick, 36 inch, by 22.9 feet long rolls, or pre-cut rolls.
 - 3) Soprema Soprasolin HD; aluminum foil-surfaced, SBS self-adhesive flashing and transition membrane for rough openings and penetrations. 40 mil thick, 39.4 inch by 32.8 feet long rolls, or pre-cut rolls.
 - 4) Soprema Sopraseal Stick Primer, 500 g/L VOC, self-adhesive membrane primer for use in Soprasolin HD and Sopraseal Stick 1100T.
 - 5) Soprema Elastocol Stick H20 Primer, water-based, 0 g/L VOC, self-adhesive membrane primer for use with Soprasolin HD and Sopraseal Stick 1100T.
 - 6) Soprema Elastocol Stick Zero Primer, zero VOC polymer based primer for use with Soprasolin HD and Sopraseal Stick 1100T.
 - 7) Sealant Soprema Sopraseal Sealant, ASTM C920, 19 g/L low VOC, moisture curing polyether sealant approved for application. 10.1 oz. or 20 oz. sausages.
 - 8) Polyurethane Foam Sealant: Approved by manufacturer for compatibility with fluid applied air barrier.
 - 9) Flashing (Counter) for Masonry at Through-Wall Flashings or Transition Membranes: Refer to Division 04 Section "Unit Masonry".
6. Material: GE Elemax 2600 by Momentive Performance Materials at 17 mils (dry) www.ge.com/silicones:
 - a. Air Barrier Material Properties
 - 1) Air permeance for this material has been tested and reported as being 0.0006 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0006 cfm/ft² @ 1.57 psf), at 17 mils (dry) when tested in accordance with ASTM E2178 (unmodified).
 - 2) Water vapor permeance for this material has been tested and reported as being 581 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential 10.16 US perms at 17 mils (dry) when tested in accordance with ASTM E 96 (water method – unmodified).
 - b. Air Barrier Accessory Materials:
 - 1) Solvent-Based Primer: SS80
 - 2) Sealants: CSC2000, SCS9000, SCS2700
 - 3) Transition Membrane for details and terminations: UST2200, USM pre-formed silicone molded corner parts.
 - 4) Solvent-Based Primer for Flashing, Transition Strip and Detail Membrane: SS80
 - 5) Substrate Joint Treatment: SCS2000, SCS9000, SCS2700

2.4 ACCESSORY MATERIALS

- A. Requirement: 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, lab sealants, and other accessory materials that are specified hereinbefore or specifically 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 substrate by air-barrier material manufacturer.

- C. Stainless-Steel Sheet: ASTM A 240, type 304, 0.0187 inch minimum thick, and Series 300 stainless-steel fasteners.
- D. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. GE Construction Sealants; Momenive Performance Materials Inc.
 - b. Pecora Corporation
 - c. The Dow Chemical Co.
 - d. Tremco Incorporated

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The Air Barrier Contractor shall examine substrates, areas, and conditions under which air and vapor barrier assemblies will be applied, with Installer present, for compliance with requirements.
 - 1. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.
 - 2. Do not proceed with installation until after minimum concrete curing period recommended by air and vapor barrier manufacturer.
 - 3. Ensure that the following conditions are met:
 - a. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants
 - b. Concrete surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions.
 - c. Masonry joints are flush and completely filled with mortar, and all excess mortar sitting on masonry ties has been removed.
 - 4. Verify substrate is surface dry. Test for capillary moisture by plastic sheet method according to ASTM D4263 and take suitable measures until substrate passes moisture test. Surface dry is an acceptable substrate condition if acceptable to the manufacturer.
 - 5. Verify sealants used in sheathing are compatible with membrane proposed for use. Perform field peel-adhesion test on materials to which sealants are adhered.
 - 6. Notify A/E in writing of anticipated problems using air and vapor barrier over substrate prior to proceeding.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air and vapor barrier application.
 - 1. Ensure that penetrating work by other trades is in place and complete.
 - 2. Prepare surfaces by brushing, scrubbing, scraping, grinding, or compressed air to remove loose mortar, dust, oil, grease, oxidations, mill scale and other contaminants which will affect adhesion of the fluid-applied membrane.
 - 3. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.
 - 4. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
 - 5. Wipe down metal surfaces to remove release agents or other non-compatible with the primary air material.
- B. Prime substrate for application of sheet membrane transition strips as recommended by manufacturer and as follows:
 - 1. Prime masonry, concrete substrates with conditioning primer.
 - 2. Prime glass-fiber surfaced gypsum sheathing an adequate number of coats to achieve required bond, with adequate drying time between coats.

3. Prime wood, metal, and painted substrates with primer.
 4. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air and vapor barrier and at protrusions.
- C. Prime substrate for application of fluid-applied air and vapor barrier if recommended by manufacturer based on project conditions and as follows.
- D. Protection from spray-applied materials:
1. Mask and cover adjacent areas to protect from over-spray.
 2. Ensure any required foam stop or back up material are in place to prevent over-spray and achieve complete seal.
- E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- F. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 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 base flashing to ensure continuity of air barrier with roofing membrane.
 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 4. 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. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. 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.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip or preformed silicone extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

3.4 INSTALLATION

- A. Joint Treatment:
1. Concrete and Masonry: Prepare, treat, route, and fill joints and cracks in substrate according to ASTM C1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D4258 before coating surfaces.
 - a. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.

2. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.
- B. Fluid Applied Membrane Air Barrier Installation: Install transition strip materials and fluid-applied air barrier to provide continuity throughout the building envelope. Install materials in accordance with manufacturer's recommendations and as follows, unless manufacturer recommends other procedures in writing based on project conditions or particular requirements of their recommended materials:
1. Install veneer anchors as per air barrier manufacturer installation sequencing.
 2. Apply treatment to exterior gypsum joints and screw heads as per air barrier material manufacturer.
 3. Apply primer for transition strips at rate recommended by manufacturer. Allow primer to dry completely before transition strip application. Apply as many coats as necessary for proper adhesion.
 4. Position subsequent sheets of transition material so that membrane overlaps the membrane sheet below by a minimum of 2 inches, unless greater overlap is recommended by manufacturer. Roll into place with roller.
 5. Overlap horizontally adjacent pieces of transition material a minimum of 2 inches, unless greater overlap is recommended by manufacturer. Roll seams with roller.
 6. Seal around all penetrations with termination mastic, extruded silicone sealant, membrane counterflashing or other procedure in accordance with manufacturer's recommendations.
 7. Connect air and vapor barrier in exterior wall assembly continuously to the air barrier of the roof, to concrete below-grade structures, to windows, curtain wall, storefront, louvers, exterior doors and other intersection conditions and perform sealing of penetrations, using accessory materials and in accordance with the manufacturer's recommendations.
 8. At changes in substrate plane, provide transition material (bead of sealant, mastic, extruded silicone sealant, membrane counterflashing or other material recommended by manufacturer) under membrane to eliminate all sharp 90-degree inside corners and to make a smooth transition from one plane to another.
 9. Provide mechanically fastened non-corrosive metal sheet to span gaps in substrate plane and to make a smooth transition from one plane to the other. Membrane shall be continuously supported by substrate or as recommended by the manufacturer.
 10. At through-wall flashings, provide an additional 6-inch wide strip of manufacturer's recommended membrane counterflashing to seal top of through-wall flashing to membrane or as recommended by manufacturer. Seal exposed top edge of strip with bead of mastic or as recommended by manufacturer.
 11. At deflection and control joints, provide backup for the membrane to accommodate anticipated movement.
 12. At expansion and seismic joints provide transition to the joint assemblies.
 13. Apply a bead or trowel coat of mastic along membrane seams at reverse lapped seams, rough cuts, and as recommended by the manufacturer.
 14. At end of each working day, seal top edge of the self-adhered membrane to substrate with termination mastic.
 15. Do not allow materials to come in contact with chemically incompatible materials.
 16. Do not expose membrane to sunlight longer than as recommended by the manufacturer.
 17. Inspect installation prior to enclosing assembly and repair punctures, damaged areas and inadequately lapped seams with a patch of membrane lapped as recommended by manufacturer.

3.5 FIELD QUALITY CONTROL

- A. Owner's Inspection and Testing: Cooperate with Owner's testing agency. Allow access to work areas and staging. Notify Owner's testing agency in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Daily inspection and testing may be required. Do not cover Work of this Section until testing and inspection is accepted.

- B. Manufacturer's Technical Representative: Observe installation procedures at the indicated completion percentages.
 - 1. Do not cover work prior to inspection or testing by Manufacturer's Technical Representative.
 - 2. If the inspection reveals any defects, promptly remove and replace defective work at no additional cost to the Owner.
 - 3. Provide written report of observations when on-site to the A/E and CM.

3.6 PROTECTING AND CLEANING

- A. Protect air and vapor barrier assemblies from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Coordinate with installation of materials which cover air and vapor membrane, to ensure exposure period does not exceed that recommended by the air and vapor barrier manufacturer.
 - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air barrier manufacturer.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

END OF SECTION 07 27 26.02

SECTION 07 31 13 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following: Refer to Alternates.
 - 1. Glass-fiber-reinforced asphalt shingles.
 - 2. Underlayment materials.
 - 3. Metal flashing and trim.
 - 4. Ridge vents.
- B. Related Sections include the following:
 - 1. Division 06 Section "Sheathing" for roof deck wood structural panels; including vented composite decking.
 - 2. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, counterflashings, and flashings.

1.2 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.3 PREINSTALLATION MEETINGS

- A. Pre-installation Meeting: Conduct meeting at Project site. A/E will schedule and conduct meeting. Representative of the Roofing Contractor (Project Superintendent), asphalt shingle manufacturer, and other subcontractors whose work complements, penetrates, or is mounted on the roof shall be in attendance.
 - 1. Review shingle manufacturers installation and warranty requirements, including items relating to compatibility and ventilation.

1.4 PERFORMANCE REQUIREMENTS

- A. Wind Resistance: Asphalt shingles shall be tested in accordance with ASTM D 3161 and D 7158. Asphalt shingles shall meet classification requirements D, G, or H for a maximum basic wind speed of 90 mph, unless otherwise indicated.
 - 1. Attachment: Asphalt shingles shall have the minimum number of fasteners required by the manufacturer to meet wind requirements indicated. Asphalt shingles shall be secured to the roof with not less than four fasteners per strip shingle or two fasteners per individual shingle.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Submit manufacturer's specifications and installation instructions for each material and include other data as may be required to show compliance with these Specifications. Indicate by transmittal form that a copy of each installation instruction has been distributed to the installer.
 - 1. Certificates
 - a. Shingle manufacturer shall submit a letter stating contractor has been trained and approved for installation of units required for this Project.
 - b. Contractor/Installer shall certify in writing that shingles have been installed in accordance with manufacturer's recommendations.
 - 2. Sample Executable Warranty: Copy of shingle manufacturer's warranty stating obligations, remedies, limitations, and exclusions before starting work.
 - 3. Research/Evaluation Reports: For synthetic roofing underlayment from the ICC.
- B. Samples for Verification: For the following products, of sizes indicated, to verify color selected.
 - 1. Asphalt Shingle: Full-size asphalt shingle strip.
 - a. Provide at project site for review by A/E representative.

1.6 CLOSEOUT SUBMITTALS:

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 - 1. Maintenance Data: For asphalt shingles to include in maintenance manuals.
 - 2. Warranties: Special warranties specified in this Section.
 - 3. Receipt of extra materials.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to install and receive a manufacturer's 50 year (or manufacturer longest period for specified product) no-dollar-limit warranty. Installer must verify this approval with a letter from manufacturer and supply letter even if a lesser warranty is specified.
 - 1. Manufacturer's representative shall be available and attend the Pre-installation Conference at Project Site and visit the project at appropriate intervals, minimum 2 visits, during construction and additionally at completion of construction.
- B. Shingles shall conform to ASTM D3462 Standard Specification for Asphalt Shingles made from Glass Felt and Surfaced with Mineral Granules.
 - 1. Manufacturer's label on each bundle of shingles shall contain reference to the ASTM standard and date of fabrication.
 - a. Shingles shall be manufactured within 120 days of the projected date of use. Provide date of manufacture for each bundle of shingles upon delivery to the Project site. Old shingles that show signs of improper storage and have started to seal together prematurely will be cause for rejection.
- C. Maintain one copy of manufacturer's application instructions on the project site.
- D. Source Limitations: Obtain ridge and hip cap shingles ridge vents, felt underlayment, and self-adhering sheet underlayment through one source from a single asphalt shingle manufacturer or letter of endorsement of other products.
- E. Fire-Test-Response Characteristics: Provide asphalt shingle and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double-stack rolls.
 - 1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
 - 2. Do not store shingles in direct sunlight prior to installation.
- B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt shingle roofing to be performed according to manufacturer's written instructions and warranty requirements.
 - 1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

- B. Hot Weather Recommendations for Storage and Application of Asphalt Roofing Shingles.
1. Removing Shingles from Bundles: Although shingles have a release film to prevent from sticking to each other in the package, making the shingles more difficult to separate and remove from the bundle. When removing shingles from a warm bundle, follow the manufacturer's recommendations; some products may separate better or more easily when removed from the bundle "granule side up" or by quickly snapping the shingles out of the bundle stack. This helps "shear" any taut sealant bond which may be forming between shingle sealant and release films, allowing easier separation and minimizing potential shingle damage.
 2. During Application: Always be careful when working on sloped roofs. In hot weather applications, the asphalt coating on the shingles may become softer, allowing for potential foot slippage. Wear proper soft-soled footwear to minimize foot slippage possibilities, and ensure roof safety by following all required safety precautions, which may include use of fall protection devices. Soft-soled shoes can also minimize shingle scuffing or damage.
 - a. One should also plan the roof installation to "work around the sun," i.e. work on the west-facing slopes in the morning and east-facing slopes later in the day. As previously mentioned, direct sunlight may slightly soften the asphalt shingle coating, rendering the shingles susceptible to scuffing from roofing work and foot traffic. This is especially true on steeper roofs where worker footprints, such as toe or heel marks, are likely to be more concentrated in small areas. Use reasonable care to minimize any scuffing and, if necessary, wait until the shingles and ambient temperatures cool.
 - b. In hot weather, shingle pieces trimmed for hips, ridges, rakes, and valleys can quickly adhere to shingles that are already applied if left on the roof with their sealant strip down. Use good housekeeping practices to minimize shingle debris on the roof.
 3. Other Conditions: Almost all asphalt shingles are manufactured with a thermally activated asphaltic sealant which bonds the shingles together once they are applied to the roof and exposed to a sufficient period of heat from sunlight. If this sealant has been affected (blinded) by wind-blown dust from the surrounding environment or the site (e.g. saw dust). The sealant may not activate even on hot sunny days and the shingles will need to be manually sealed per the shingle manufacturer's instructions. On north-facing or steeper slopes the shingles may not seal immediately even in warmer weather and may require manual sealing.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period. Materials failures include manufacturing defects and failure of asphalt shingles to self-seal after a reasonable time.
1. Special Warranty or separate warranty shall include all products provided by the Shingle Manufacturer as part of roofing assembly.
 2. Material Warranty Period: Minimum 40 years from date of Substantial Completion depending on Manufacturer product specified, prorated, with minimum first 5 years nonprorated.
 3. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds up to 110 mph.
 4. Warranty against algae growth: Limited Lifetime.
- B. Special Project Warranty: Roofing Installer's warranty, on warranty form at end of this Section, signed by roofing Installer, covering Work of this Section, in which roofing Installer agrees to repair or replace components of asphalt shingle roofing that fail in materials or workmanship within the following warranty period:
1. Warranty Period: Two years from date of Substantial Completion.

1.11 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Asphalt Shingles: 100 sq. ft of each type or 2 percent, whichever is greater, in unbroken bundles.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products from one of the manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 SHINGLES

- A. Laminated-Strip Asphalt/SBS Shingles: ASTM D 3462, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
 - 1. Products:
 - a. Timberline Prestique High Definition; Elk/GAF Corp.
 - b. Cambridge LT; IKO.
 - c. Premier Advantage; PABCO Roofing Products.
 - d. Landmark Preminum; CertainTeed Corp.
 - e. Stormmaster LM 50; Atlas Roofing Corp.
 - f. Highlander; Malarkey Roofing Products.
 - 2. Butt Edge: Straight
 - 3. Strip Size: Manufacturer's standard.
 - 4. Color and Blends
 - a. As selected by A/E from manufacturer's full range.
- B. Starter Roll or Factory-Cut Starter Shingle: Shingle manufacturer's pre-fabricated, granular or mineral surfaced, glass-fiber-reinforced asphalt sheet product with factory-applied strip of adhesive/sealant paralleling bottom edge. Product shall be specifically designed to replace traditional field-fabricated starter course and provide first course of shingles with resistance to wind uplift and a slope consistent with subsequent shingle courses.
- C. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

2.3 UNDERLAYMENT MATERIALS

- A. Synthetic Underlayment: Comply with ASTM D8257. High-strength, spun-bonded polypropylene base sheet, co-extruded on both sides with UV stabilized polyolefin, if approved by shingle manufacturer and authorities with jurisdiction. Provide evaluation reports by ICC Evaluation Service (ICC-ES) to demonstrate compliance to the code authority having jurisdiction.
 - 1. Product: Subject to compliance with requirements and shingle manufacturers approval, provide products by the following manufacturer.
 - a. Grace Tri-Flex 30; W.R. Grace
 - b. Deck-Armor; GAF
 - c. Proof Underlayment, Insulation Solutions

- d. Summit Synthetic Shingle Underlayment; Atlas
- e. Roof-Gard; IKO
- f. SecureStart Synthetic Underlayment 1030; Malarkey Roofing Products.

2.4 WATER AND ICE-DAM PROTECTION MEMBRANE

- A. Self-Adhering, Polymer-Modified Bitumen Sheet Underlayment: ASTM D 1970; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied. Provide primer for adjoining concrete, masonry, and metal surfaces to receive underlayment.
 - 1. Products shall be acceptable to shingle manufacturer for conditions indicated and meet warranty requirements.
 - a. Basis-of-Design: Artic Seal roofing Underlayment; Malarkey Roofing Products.

2.5 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Elastomeric Flashing Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag, elastomeric polymer sealant; of class and use classifications required to seal joints and remain watertight; recommended in writing by manufacturer for installation of flashing systems.
- C. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized steel wire shingle nails, minimum 0.120-inch diameter, barbed shank, sharp-pointed, with a minimum 3/8-inch diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/4 inch through OSB or plywood sheathing. Staple fasteners are not acceptable.
 - 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- D. Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized steel wire with low profile capped heads or disc caps, 1-inch minimum diameter.
 - 1. Synthetic underlayment is to be attached in accordance with manufacturer's recommendations.
- E. Pipe Flashing: Molded silicone rubber elastomeric seal and UV stable PVC compression ring to fit pipe diameters 1-1/4 inch to 4 inches.
 - 1. Sheet metal flange flashing plate: 24 gauge zinc coated steel sheet (galvanized) ASTM A 653/A 653 M, G90 coating with 4 nailing slots.
 - 2. Manufacturer: "Ultimate Pipe Flashing" by Lifetime Tool & Building Products, Winchester, Virginia.

2.6 RIDGE VENTS

- A. Rigid Ridge Vent: Manufacturer's standard rigid section high-density polypropylene or other UV-stabilized plastic ridge vent with nonwoven geotextile filter strips and with external deflector baffles; for use under ridge shingles.
 - 1. Products shall be acceptable to shingle manufacturer for conditions indicated and meet warranty requirements.
 - 2. Minimum Net Free Area: 1:150.
 - 3. Feature: Nonwoven geotextile filter strips or external deflector baffles to block rain and snow entry.

2.7 METAL FLASHING AND TRIM

- A. Sheet Metal Flashing and Trim: Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
 - 3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROOF DECK PREPARATION

- A. Follow shingle manufacturer's recommendations for acceptable roof deck materials.
- B. Broom clean deck surfaces prior to underlayment application.

3.3 UNDERLAYMENT INSTALLATION

- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirement to meet shingle warranty requirements apply.
- B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof deck in locations indicated below. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Lap in direction to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days or as allowed by Manufacturer's written instructions.
 - 1. Additional extend self-adhering sheet underlayment at intersections of roof deck as follows:
 - a. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
 - b. Eaves: Extend from edges of eaves 36 inches beyond interior face of exterior wall.
 - c. Rakes: Extend from edges of rake 36 inches beyond interior face of exterior wall.
 - d. Hips: Extend 18 inches on each side.
 - e. Ridges: Extend 36 inches on each side without obstructing continuous ridge vent slot.
 - f. Sidewalls: Extend beyond sidewall 18 inches and return vertically against sidewall not less than 4 inches.
 - g. Dormers, Chimneys, Skylights, and other Roof-Penetrating Elements: Extend beyond penetrating element 18 inches and return vertically against penetrating element not less than 4 inches.
 - h. Roof Slope Transitions: Extend 18 inches on each roof slope.
- C. Synthetic Undelayment
 - 1. Install on roof deck parallel with and starting at the eaves.
 - a. Lap sides and ends as recommended in writing by manufacturer, but not less than 2 inches for side laps and 6 inches for end laps.
 - b. Stagger end laps between succeeding courses at interval recommended in writing by manufacturer, but not less than 72 inches.
 - c. Fasten with underlayment nails in accordance with manufacturer's written instructions.
 - d. Cover underlayment within period recommended in writing by manufacturer.
 - 2. Install in single layer on roofs sloped at 4:12 and greater.

3. Install synthetic underlayment on roof deck not covered by self-adhering sheet underlayment.
 - a. Lap sides of underlayment over self-adhered sheet not less than 4 inches in direction of water flow.
 - b. Lap ends of underlayment not less than 6 inches over self-adhering sheet.
 4. Install fasteners in grid pattern of 12 inches between side laps with 6 inch spacing at side and end laps.
- D. Metal-Flashed Open Valley Underlayment: Install layer of water and ice-dam protective membrane centered in valley. If membrane is lapped, the ends should overlap at least 12 inches.
1. Strip in the flanges on each side of the metal valley with a 9- to 12-inch strip of membrane.

3.4 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim."
1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
 2. Unless otherwise noted, weather lap joints a minimum of 2 inches and seal weather tight with plastic cement.
- B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.
- C. Cricket or Backer Flashings: Install against the roof-penetrating element extending concealed flange beneath upslope asphalt shingles and beyond each side.
- D. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck about 12 inches on center, slightly staggered.
- E. Eave Drip Edges: Install eave drip edge flashings below underlayment unless otherwise noted, and fasten to roof sheathing about 12 inches on center, slightly staggered.
1. Where drip edges terminate into gutters install water and ice-dam protection membrane before installing the drip edge and run it over the front of the fascia and behind the gutter. The drip edge covers the membrane and a second layer of water and ice-dam protection membrane is installed over the drip edge and sealed with a bead of urethane sealant.
- F. Open Valley Flashings: Install centrally in valleys, lapping ends at least 8 inches in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.
1. Secure hemmed flange edges into metal cleats spaced 12 inches apart and fastened to roof deck.
 2. Adhere 9-inch wide strip of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.
 - a. Place strips parallel to and over flanges so that they will be just concealed by installed shingles.
 3. Provide a closure at the end of the inverted – V profile of the valley metal to minimize water and ice infiltration.
- G. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.5 ASPHALT SHINGLE INSTALLATION

- A. Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

- B. Install shingle manufacturer's starter roll or factory-cut starter shingle per shingle manufacturer's installation instructions.
 - 1. The lower edge or edges of roofing material should be even with the outer edge of the perimeter metal flashing.
 - 2. The starter course should be fastened with roofing nails along a line that is parallel to and 2-1/2-inches to 4 inches above the downslope perimeter edges of the roof. The nails should be placed in such a way that the nail heads will not be exposed through the overlaying shingles cutouts or at butt joints between individual shingles that make up the first course.
- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Fasten asphalt shingle strips with a minimum of four roofing nails located according to manufacturer's written instructions to meet wind loads specified.
 - 1. When ambient temperature during installation is below 50 deg F (10 deg C), seal asphalt shingles with asphalt roofing cement spots.
 - a. Provide at least three spots of sealant. The top size courses of the roof and rake courses are especially susceptible to wind blow-off and must be sealed.
 - 2. Where roof slope is less than 4:12, seal asphalt shingles with asphalt roofing cement spots.
- E. Open Valleys: A metal valley shall be constructed by installing 8-foot to 10-foot lengths of metal from low point to the high point in the valley over a layer of water and ice-dam protective membrane. Secure metal with nails along outer flanges. Fasteners should be kept back from center of valley as far as possible. Strip the flanges on each side with an additional layer of membrane.
 - 1. Provide a closure at the eave end of the W-shaped valley metal to minimize water and ice infiltration.
 - 2. Asphalt shingles are lapped onto both sides of valley a minimum of 4 inches and set in 3-inch wide bed of asphalt roofing cement. Do not fasten shingles through metal valley flashing.
 - 3. Taper valley 1/8 inch for 12 inches so it is wider at its low point than it is at its high point.
- F. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing in full accordance with manufacturer's recommendations to meet same uplift requirements as specified for shingles.
- G. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
 - 1. Exposed fasteners should be sealed with sealant or asphalt roof cement on the last ridge piece of a run at the intersection of hips to a ridge and at the intersection of a ridge to another plane.

3.6 PROTECTION

- A. Do not permit traffic over finished roof surface.

3.7 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1. Owner: <Insert name of Owner.>
 - 2. Address: <Insert address.>
 - 3. Building Name/Type: <Insert information.>
 - 4. Address: <Insert address.>
 - 5. Area of Work: <Insert information.>
 - 6. Acceptance Date: <Insert date.>

7. Warranty Period: **<Insert time.>**
8. Expiration Date: **<Insert date.>**

- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding 80 mph (m/sec);
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
 6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
 7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.
- E. IN WITNESS THEREOF, this instrument has been duly executed this **<Insert day>** day of **<Insert month>**, **<Insert year>**.
1. Authorized Signature: **<Insert signature.>**
 2. Name: **<Insert name.>**
 3. Title: **<Insert title.>**

END OF SECTION 07 31 13

SECTION 07 41 13.00 - METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Metal roof panels.
 - 1. Factory formed and field assembled, standing seam metal roof panels.
 - 2. Metal gutters and downspouts.
 - 3. Snow guards and diverters to protect stacks, vent pipes, and equipment.
 - 4. Underlayment.

1.2 DEFINITIONS

- A. Roofing Terminology: See ASTM D1079 and glossary in NRCA: "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
- B. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight roofing system.
- C. Solar Reflectance: Fraction of solar flux reflected by a surface, expressed as a percent or within range of 0.00 and 1.00.
- D. Solar Flux: Direct and diffuse radiation from sun received at ground level over solar spectrum, expressed in watts per square meter.
- E. Hydrostatic: Assembly is designed to resist hydrostatic pressure from standing water.
- F. Hydrokinetic: Assembly is water shedding and may rely on underlayment for watertightness. Normal reserved for steep slope applications 3:12 or greater.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Meeting: 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 roof accessories and roof-mounted equipment.
 - 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 structural loading limitations of deck during and after roofing.
 - 6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
 - 7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 8. Review temporary protection requirements for metal panel systems during and after installation.
 - 9. Review procedures for repair of metal panels damaged after installation.
 - 10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For standing-seam metal roof panels. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
 - 1. Sample (Executable) Warranties: For special warranties.
- B. Shop Drawings: Show profile and gauge of items, location and type of fasteners; location, gauge, shape, and method of attachment of trim; and other details as may be required for a weathertight installation.
 - 1. Manufacturer shall prepare shop drawings. Contractor prepared shop drawings are not acceptable.
 - 2. Do not proceed with manufacture prior to review of shop drawings. Do not use Drawings prepared by A/E for shop or erection drawings.
 - 3. Shop drawings shall show methods of erection, elevations, and plans of roof panels, sections and details, anticipated loads, flashings, roof curbs, vents, sealants, interfaces with materials not supplied, and proposed identification of component parts and their finishes. Show fabrication and installation layouts of metal roof panels; details of edge conditions, side-seam and end lap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; special details. Distinguish between factory and field-associated work.
 - 4. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by qualified professional engineer responsible for their preparation.
 - 5. Accessories: Include details of following items, at a scale of not less than 1-1/2 inches per 12 inches.
 - a. Flashing and trim.
 - b. Gutters.
 - c. Downspouts.
 - d. Snow guards.
 - 6. Submit shop drawings indicating number of rows and spacing of rows for snow guards and clamps required at locations indicated in accordance with snow guard manufacturer's design. Submit design formulation with shop drawings. Indicate locations of diverters to protect penetrations.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Panels shall be factory-produced only.
 - 1. Panels shall not be roll-formed on-site nor fabricated on a portable roll-former. Provide manufactured roofing systems as specified. Manufactured roof system shall be identified as fixed equipment.
- C. Panels shall be designed in accordance with sound engineering methods and practices and in accordance with latest edition of AISI's "Specification for Design of Cold Formed Steel Structural Members."

1.7 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 roof area and eave, including fascia, as shown on Drawings; approximately 48 inches square by full thickness, including attachments, underlayment, 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. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 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.

1.9 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.

1.10 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

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

- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, following requirements apply for product selection:
1. Manufacturers: Subject to compliance with requirements, provide product by manufacturers specified.
 2. Products: Subject to compliance with requirements, provide one of products specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. Requests for A/E's approval must be accompanied by "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 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.
 2. Other Design Loads: As indicated on Drawings.
 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Panels to Meet:
1. Water Penetration: When tested per ASTM E-283/1680 and ASTM E-331/1646 there shall be no uncontrolled water penetration or air infiltration through the panel joints.
 2. Roof System shall be designed to meet a UL Class 90 wind uplift in accordance with UL standard 580 and panel system shall be ASTM 1592 tested and approved.
 3. UL 2218 – Impact Resistance rated.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Snow Guard Performance Requirements:
1. Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacturer, fabrication, installation, or other defects in construction.
 - a. Temperature Change: 120 deg. F, ambient; 180 deg. F, material surfaces.
 2. Snow guard attachment system shall provide attachment to standing seam metal roofs:
 - a. With only minor dimpling of panel seams.
 - b. Without penetrations through roof seams or panels.
 - c. Without use of sealers or adhesives.
 - d. Without voiding roof warranty.
 3. Structural Performance: Snow Loads: As indicated on Drawings.
 - a. Snow guards for installation above doors and isolated areas calculation shall include: Building design ground snow load x safety factor of 3, and distance requested x 1.5.
 - 1) When retention for entire roof surface is used safety factor may be reduced to a factor of 2.

2.3 STANDING-SEAM METAL ROOF PANELS

- A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
 - 1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.
- B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.
 - 1. Basis of Design: "Snap-Clad" Panels by PAC-Clad.
 - 2. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AEP Span a brand of ASC Profiles LLC, a part of BlueScope.
 - b. ATAS International, Inc.
 - c. CENTRIA, a Nucor Brand.
 - d. Dimensional Metals, Inc.
 - e. Englert, Inc.
 - f. Metal Sales Manufacturing Corporation.
 - g. Morin - A Kingspan Group Company.
 - 3. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755.
 - a. Nominal Thickness: 0.028 inch, 24 gauge.
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
 - 4. Clips: Two-piece floating concealed spaced as required to accommodate thermal movement and for positive and negative design loads.
 - a. Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - 5. Panels to be produced with factory supplied mastic within seams.
 - 6. Panel Coverage: 16 inches.
 - 7. Provide intermediate stiffening/pencil ribs in panel.
 - 8. Panel Height: 1.75 inches.

2.4 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970.
 - 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D1970.
 - 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ATAS International, Inc.
 - b. Carlisle WIP Products; a brand of Carlisle Construction Materials.
 - c. GCP Applied Technologies Inc.
 - d. Henry Company.
 - e. Owens Corning.
 - f. Polyglass U.S.A., Inc.
 - g. Tamko
 - h. SDP Advanced Polymer Products Inc.
 - i. Dimensional Metals, inc.

- B. Slip Sheet: As recommended by panel manufacturer.
 - 1. Provide a slip sheet over all underlayment materials to separate underlayment from metal panels, where required by metal roofing manufacturer.

2.5 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- 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, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
 - 1. Provide manufacturer's standard vented ridge assembly at locations with attic construction.
- C. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.
 - 1. Gutter Style: As indicated.
 - 2. Expansion Joints: Concealed splice plate joints per SMACNA Fig. 1-7.
 - 3. Provide gutter brackets and straps per SMACNA, Table 1-8.
- D. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.
 - 1. Shape: Square or rectangular.
 - 2. Fabricate downspout to meet Fig. 1-32B, SMACNA.
 - a. Provide elbows, fittings, adapters, and brackets as indicated and as required for connection between collection box/scuppers/gutter outlets and drain boots.
 - 3. Fabricate hanger to meet SMACNA Fig. 1-35B or Fig. 1-35H.
 - a. Downspouts of 10 feet or less shall have two straps/hangers of support, and longer downspouts shall be supported at 10 feet maximum intervals.
- E. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- F. 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 wide and 1/8 inch 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.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

- G. Pipe Flashings: Provide EPDM (ethylene propylene diene monomer) molded rubber flashings having a serviceable temperature range of -65 degrees F. to 212 degrees F. (for standard applications) or silicone molded rubber boot having a serviceable temperature range of -100 degrees F. to 437 degrees F. (for high temperature applications) and shall be resistant to ozone and ultraviolet rays. Provide stainless steel clamping rings, sealant, and fasteners as recommended by manufacturer and a bonded aluminum ring in boot base. Do not install pipe flashings through any panel seams or panel ribs, unless unavoidable. Install only in flat portion of panel.
- H. Snow Guard Products: Product and installation method shall not affect metal roof manufacturer's warranty.
1. Seam Mounted, Angle/Channel Type Snow Guards: Held in place by stainless-steel clamps attached to vertical ribs of standing seam metal roof panels.
 - a. Model #76 "S-5"; Alpine Snow Guards, Div. of Vermont Slate & Copper Services, Inc.
 - b. ColorGuard; LMCurbs
 - c. S-5! ColorGard; Metal Roof Innovations, Ltd.
 - d. Dynamic Fastener
 - e. Petersen Aluminum Corp.
 - f. Architectural Metal Specialties, Inc. (aka AMSI Supply)
 2. Prefabricated, noncorrosive units designed to be installed without penetrating metal roof panels, and complete with drilled holes, and clamps, for anchoring. Install snow guards according to manufacturer's written instructions. Space rows as recommended by manufacturer.
 - a. Angle/Channel Type: Attach supports to vertical ribs of standing seam metal roof panels with stainless-steel clamps. Do not use fasteners that will penetrate metal roof panels.
 - b. Color: Match finish of roof panels.

2.6 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, including major ribs and intermediate stiffening ribs, if any, 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. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

5. 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 panel manufacturer for application, but not less than thickness of metal being secured.
6. Brake metal fascia trim and eave fascia trim.
 - a. Interlocking vertical joints. Joints shall provide means of expansion control.
 - b. Provide concealed splice plates with concealed fastening methods between sections of fascia trim.
 - c. Wrap wood blocking with sheet metal trim where indicated and provide concealed fasteners.
 - d. All corners shall be mitered, welded and ground smooth prior to finishing.
7. Drip Edges
8. Color: Same as metal roof panels unless indicated otherwise.

2.7 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a stripable, 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 unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- 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.
 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 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 solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing 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.

3.2 PREPARATION

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

3.3 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below and on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
1. Apply over the entire roof surface.
 2. In addition, Apply 2nd layer over the roof area indicated below:
 - a. Roof perimeter for a distance up from eaves of 24 inches beyond interior wall line.
 - b. Valleys, from lowest point to highest point, for a distance on each side of 18 inches. Overlap ends of sheets not less than 6 inches.
 - c. Rake edges for a distance of 18 inches.
 - d. Hips and ridges for a distance on each side of 12 inches.
 - e. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of 18 inches.
- B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

3.4 INSTALLATION OF STANDING-SEAM METAL ROOF PANELS

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise 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 substrates receiving metal panels.
 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal 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. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
1. Install clips to supports with self-tapping fasteners.
 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.

- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
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 and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
1. Connect downspouts to underground drainage system indicated.
- J. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.
- K. Fasteners are to be concealed wherever possible. Exposed fasteners shall be stainless steel painted to match roof panels.
- L. Brake formed cap, trim, closure, flashing sections, and other sheet metal work are to be furnished with a minimum of joints.
1. Brake formed members with exposed corner intersections shall have corner pieces shop-fabricated. Other miscellaneous trim corners may be field-cut, -mitered, or -butted.
 2. Trim shall be of same material as, and have a finish to match, metal roofing panels.
 3. Minimum length of brake formed sheet metal and flashings shall be 10 feet with concealed splice plates for joints.
- M. Install roof accessories, roof jacks at pipe penetrations in metal roofing and roof curbs at roof-mounted equipment indicated. Provide required fasteners, foam rods, plastic cement, and other sealant or material to provide watertight and weathertight construction.
- N. Snow Guards
1. Install universally along lower edge of metal roof panel assemblies, beginning at least 3 feet up from interior face of exterior wall as recommended by snow guard manufacturer and per layout on shop drawings.
 - a. Install snow guards to protect equipment on roof as well as roof valleys.
 2. Attach system to each vertical ribs of standing seam metal roof panels with clamps or setscrews. Do not use fasteners that will penetrate metal roof panels.

3. Install snow diverters specifically designed to divert snow from stacks, vent pipes, and equipment to avoid unnecessary damage.
4. When application relies upon tested load-to-failure values, minimum setscrew tension shall be randomly verified using calibrated torque wrench per manufacturer's instructions.

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.
- B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.7 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. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13

SECTION 07 42 13.16 - METAL PLATE WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes metal plate wall panels.
 - 1. Trim, flashings and closures.
- B. Related Sections:
 - 1. Division 07 Section "Sheet Metal Flashing and Trim" for field-formed flashings and other sheet metal work not part of metal wall panel assemblies.

1.2 DEFINITION

- A. Metal Plate Wall Panel Assembly: Metal plate wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

1.3 COORDINATION

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

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Meeting: A/E will schedule and conduct meeting at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal plate wall panel Installer, metal plate wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects panels including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal plate wall 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 will affect metal plate wall panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal plate wall panel assembly during and after installation.
 - 8. Review procedures for coordinating installation of wall assembly components by multiple installers and to maintain proper air-water barrier and panel substrate performance requirements.
 - 9. Review metal plate wall panel observation and repair procedures after installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal plate wall panel and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of metal plate wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):
 - a. Flashing and trim.
 - b. Anchorage systems.
 - C. Samples for Initial Selection: For each type of metal plate wall panel indicated with factory-applied color finishes.
 1. Include similar Samples of trim and accessories involving color selection.
 - D. Delegated-Design Submittal: For metal plate wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- 1.6 CLOSEOUT SUBMITTALS:
- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 1. Maintenance Data: For metal plate wall panels to include in maintenance manuals.
 2. Warranties: Sample of special warranties.
- 1.7 QUALITY ASSURANCE
- A. Installer Qualifications: An employer of workers 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 wall and corner panel, as shown on Drawings; approximately one bay wide by one story high by full thickness, including insulation, supports, attachments, and accessories. Include four-way joint.
 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. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver components, metal plate wall panels, and other manufactured items so as not to be damaged or deformed. Package panels for protection during transportation and handling.
 - B. Unload, store, and erect metal plate wall panels in a manner to prevent bending, warping, twisting, and surface damage.
 - C. Stack metal plate wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
 - D. Retain strippable protective covering on metal plate wall panel for period of installation.
- 1.9 FIELD CONDITIONS
- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal plate wall panels to be performed according to manufacturer's written instructions and warranty requirements.
 - B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal plate wall panel fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Metal plate wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Delegated Design: Design metal plate wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft..
- D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft.
- E. Structural Performance: Provide metal plate wall panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
 - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure of 20 lbf/sq.ft., unless otherwise indicated on Drawings.
 - 2. Deflection Limits:
 - a. Deflection at panel perimeter framing shall not exceed $L/175$ where "L" is unsupported span of perimeter framing member.
 - b. Deflection of panel face shall not exceed $L/60$ where "L" is unsupported span of panel.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 PANEL MATERIALS

- A. Aluminum Plate: ASTM B 209. Alloy and temper as recommended by manufacturer for application.

- B. Panel Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal plate wall panels and remain weathertight; and as recommended in writing by panel manufacturer.

2.3 MISCELLANEOUS METAL FRAMING

- A. Base or Sill Angles or Channels: 0.079-inch nominal thickness.
- B. Hat-Shaped, Rigid Furring Channels:
 - 1. Nominal Thickness: As required to meet performance requirements.
 - 2. Depth: As indicated.
- C. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous metal framing members to substrates.

2.4 MISCELLANEOUS MATERIALS

- A. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated.
- B. Panel Fasteners: Self-tapping screws; bolts and nuts; self-locking rivets and bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.
- C. Metal Plate Wall Panel Accessories: Provide components required for a complete metal plate wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of panels unless otherwise indicated.
- D. Flashing and Trim: Same material, finish, and color as adjacent metal plate wall panels, minimum 0.040 inch thick unless otherwise indicated.
 - 1. This includes but is not limited to "L" shaped closure trim, panel terminations against dissimilar materials and similar conditions.
 - 2. Provide 0.040 inch thick sill/closure/drip at bottom of panels. Shape and length of this component shall cover thickness panel assembly back to existing wall surface.

2.5 METAL PLATE WALL PANELS

- A. Metal Plate Wall Panels: Provide factory-formed, metal plate wall panels fabricated from single sheets of metal formed into a dry-joint pressure equalized rainscreen system with interlocking gutter and drainage system integral to panel with single horizontal factory pre-punched attachment. Include attachment system components, panel stiffeners, and accessories required for complete system.
 - 1. Products: Basis of Design, D7-DPS by Division 7 Metals.
 - 2. Acceptable products subject to compliance with requirements, provide one of the following:
 - a. Painted Aluminum Wall Panels; Dri-Design.
 - b. SL-1000 P; Sobotec Ltd.
 - c. Protean
 - 3. System:
 - a. Folded and returned panel design.
 - b. Dry concealed joint, rain screen, ventilated and back-drained system.
 - 4. Material: Tension-leveled, smooth aluminum sheet, 3003-H14, 0.063 inch thick, minimum.
 - a. Where indicated provide perforated panels for ventilation. Provide screening or filter fabric behind perforations for insect obstructions. Utilize manufacturer's standard perforation pattern.

5. Material: Tension-levleed, smooth aluminum sheet, 3003-H14, 0.063 inch thick, minimum.
 6. Panel Depth: 1.25 inch.
 7. Exterior Finish:
 - a. Two-coat fluoropolymer
 - 1) Custom color as selected by A/E.
- B. Attachment System Components: Formed from extruded aluminum.
1. Provide internal drainage system.
 2. Include manufacturers standard subgirts, panel stiffeners, and panel clips.
- C. Assembly Components:
1. System Construction: Fabricate panels with corners fully welded and ground smooth to finishing. Folded-open corners are not acceptable.
 2. Panel Stiffeners: Where required by design loads applied to panels, pan stiffeners shall be secured to the rear face of the panel with silicone or sufficient size and strength to maintain panel flatness.
 3. Panel Fasteners: Type 304 stainless steel, aluminum or zinc plated for panel attachment in size and spacing as dictated by structural requirements.
 4. Panel terminations to adjacent construction will be sealed in the field with a nominal 1/2 inch joint sealer consisting of backer rod and sealant as recommended by the panel system fabricator to meet system performance requirements.
 5. Weldment fabrications: Grind welds smooth prior to finishing.

2.6 FABRICATION

- A. General: Fabricate and finish metal plate wall panels and accessories at the factory to greatest extent possible, 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. Fabricate metal plate wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Metal Plate Wall Panels: Fabricate panels with panel stiffeners as required to comply with deflection limits. Weld and grind panel corners smooth. Fabricate panels to the following dimensional tolerances:
1. Length and Width: Plus or minus 0.032 inch up to 48 inches; 0.064 inch more than 48 inches.
 2. Diagonal: Plus or minus 0.1875 inch.
 3. Panel Bow: Not more than 0.2 percent of panel width or length up to 0.1875 inch maximum.
 4. Thickness: Plus or minus 0.008 inch.
 5. Squareness: 0.1875-inch difference between diagonal measurements.
 6. Camber: 0.032 inch.
- D. Sheet Metal Accessories: Fabricate flashing and trim to comply with 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.
 - a. Flashing and Trim: Same material, finish, and color as adjacent metal plate wall panels, minimum 0.040 inch thick unless otherwise indicated.
 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal plate wall panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal plate wall panel manufacturer for application, but not less than thickness of metal being secured.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical 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 not acceptable. 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.

2.8 ALUMINUM FINISHES

- A. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- B. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal plate wall panel supports, and other conditions affecting performance of the Work.
 1. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal plate wall panel manufacturer.
 2. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
 3. Verify that air/water has been properly installed over substrate.
- B. Examine roughing-in for components and systems penetrating metal plate wall panels to verify actual locations of penetrations relative to seam locations of panels before installation.
- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous metal plate wall panel support members and anchorage according to ASTM C 754 and panel manufacturer's written instructions.

3.3 METAL PLATE WALL PANEL INSTALLATION

- A. General: Install metal plate wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Commence metal plate wall panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
 - 2. Shim or otherwise plumb substrates receiving metal plate wall panels.
 - 3. Flash and seal metal plate wall panels with weather closures at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
 - 4. Install flashing and trim as metal plate wall panel work proceeds.
 - 5. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
 - 6. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- B. Fasteners:
 - 1. Aluminum Plate Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal plate wall panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall plate panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.
 - 1. Seal metal plate wall panel end laps with double beads of sealant, full width of panel. Seal side joints where recommended by panel manufacturer.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- E. Attachment System, General: Install attachment system required to support metal plate wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, and anchor channels.
 - 1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- F. Flange-Attachment Installation: Attach metal plate wall panels, formed with extended perimeter flanges, to supports at locations, spacings, and with fasteners recommended by manufacturer.
 - 1. Install metal wall panels with top attachment in pre-punched holes to allow individual panel movement.
 - 2. Seal horizontal and vertical joints between adjacent panels with manufacturer's standard gaskets.
- G. Rainscreen-Principle Installation: Provide manufacturer's standard pressure-equalized, rainscreen-principle system of factory-formed metal plate wall panels fabricated from single sheets of metal formed with interlocking gutter and drainage system integral to panel with single horizontal attachment to complete dry-joint rainscreen assembly. Attach metal plate wall panels in a progressive interlocking method by engaging bottom of panel on top of previous panel working left to right.
 - 1. Do not fasten perimeter of panel or compromise internal gutter.
 - 2. Do not apply sealants to joints unless otherwise indicated on manufacturer shop drawings or at dissimilar materials.

3.4 ACCESSORY INSTALLATION

- A. General: 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 plate wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. 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 will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.5 ERECTION TOLERANCES

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

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal wall panel installation, including accessories.
- B. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.7 CLEANING

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

END OF SECTION 07 42 13.16

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following sheet metal flashing and trim: Refer to Alternates.
 - 1. Formed roof drainage sheet metal fabrications.
 - 2. Formed steep-slope roof sheet metal fabrications.
- B. Related Sections include the following:
 - 1. Division 04 Section "Unit Masonry" for installing through-wall flashing, reglets, and other sheet metal flashing and trim.
 - 2. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 3. Division 07 Section "Asphalt Shingles" for installing sheet metal flashing and trim integral with roofing.
 - 4. Division 07 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.2 REFERENCES

- A. American Society of Testing and Materials (ASTM)
 - 1. ASTM A 792 – Standard Specification for Steel Sheet, 55 percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- B. National Roofing Contractors Association (NRCA)
 - 1. NRCA Guidelines for Architectural Metal Flashings.
- C. Sheet Metal and Air Conditioning Contractors National Association, Inc., (SMACNA).
 - 1. Architectural Sheet Metal Manual.

1.3 DEFINITIONS

- A. Shop or Field Formed Sheet Metal: Include components that will be formed or fabricated in the field or at the fabricator's shop. Fabrication of sheet metal flashing and trim roofing is predominantly by press brake forming.
 - 1. Shop or field formed roof membrane termination are not acceptable.
- B. Prefabricated or Manufactured Roof Specialties: Items that will be plant manufactured ready for installation on a roof or parapet. Edge securement for low-slope roofs shall demonstrate compliance with ANSI/SPRI ES-1.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination
 - 1. 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.
 - 2. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leak-proof, secure, and noncorrosive installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including sealants. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
 - 1. Identify material, thickness, weight, and finish for each item and location in Project.

2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
 4. Include details of termination points and assemblies.
 5. Include details of expansion joints and expansion joint covers, including showing direction of expansion and contraction from fixed points.
 6. Include details of roof penetration flashing.
 7. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashing.
 8. Include details of special conditions.
 9. Include details of connections to adjoining work.
 10. Detail formed flashing and trim at scale of not less than 1-1/2-inches, including reglet (through wall flashing) details of corners, end dams, and other special applications.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
1. Sheet Metal Flashing: 8 inches by 8 inches.

1.6 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
1. Special warranty specified in this Section.

1.7 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" and NRCA's "The NRCA Roofing Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
1. If there is a discrepancy between the references and the project specifications and drawings, the more stringent requirements shall govern as determined by the A/E.
- B. 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.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage. Do not store sheet metal flashing and trim materials in contact with other materials that cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
- D. 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.

1.9 WARRANTY

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim 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. Complete sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
 - 1. If there is a discrepancy between these references and the project specification or drawings, the more stringent requirements shall govern as verified by A/E.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
 - 1. Comply with through wall flashing requirements of Brick Industry Association (BIA) "Technical Note No. 7 – Water Penetration Resistance – Design and Detail."
- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing 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 sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

2.2 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.3 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
 - 1. Contractor may use one of the following materials.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14; with smooth, flat surface.
 - 1. Exposed Coil-Coated Finish.
 - a. Fluoropolymer 2-Coat System: AAMA 620 Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight.
 - 1) Color: As selected by A/E from manufacturer's full range.
 - 2. Concealed Finish: pretreated with manufacturers' standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
- C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792, Class A250 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A 755.
 - 1. Surface Smooth, flat
 - 2. Exposed Coil-Coated Finishes: Fluoropolymer 2-Coat System: AAMA 621 Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight.
 - 1) Color: As selected by A/E from manufacturer's full range.
 - b. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
- D. Stainless-Steel Sheet: ASTM A 240, Type 304.
 - 1. Finish: No. 2D (dull, cold rolled).

2.4 UNDERLAYMENT MATERIALS

- A. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant, suitable for high temperatures over 220 deg. F.; and complying with physical requirements of ASTM D226 for Type II felts.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Atlas Roofing Corporation; Summit
 - b. Kirsch Building Products, LLC; Sharkskin Ultra
 - c. SDP Advanced Polymer Products Inc.; Palisade

2.5 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 2. Fasteners for Aluminum Sheet: Series 300 stainless steel.

- C. Solder:
 - 1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- E. Elastomeric Sealant, where indicated only: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
 - 1. Provide where sealant is exposed or movement exceeds butyl sealant movement capability.
- F. Butyl Sealant, unless otherwise noted: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.6 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" and NRCA's "The NRCA Roofing Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricated items where practicable. Obtain field measurements for accurate fit before shop fabrication.
 - 1. 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.
 - 2. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
 - 4. Apron Flashings: Fabricate with lower flange that extends a minimum of 4 inches over down-slope asphalt shingles and 4 inches beyond each side of vertical surface, and with upper flange that extends 6 inches up the vertical surface.
 - 5. Step Flashings: Fabricate with a headlap of 2 inches and a minimum extension of 4 inches over the underlying asphalt shingle and up the vertical surface.
 - 6. Cricket or Backer Flashings: Fabricate with concealed flange extending a minimum of 24 inches beneath upslope asphalt shingles and 6 inches beyond each side of chimney or skylight and 6 inches above the roof plane.
 - 7. Drip Edges: Fabricate in lengths not exceeding 10 feet with 2-inch roof deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.
- 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 on slope and location lines indicated on Drawings and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.
 - 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on drawings.
- D. Sealant Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
 - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.
- F. Seams
 - 1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant, unless otherwise recommended by sealant manufacturer for intended use.
- G. Do not use graphite pencils to mark metal surfaces.

2.7 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA Table 1-8 but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
 - 1. Gutter Style: As indicated.
 - 2. Expansion Joints: Butt type with cover plate per SMACNA Fig. 1-7.
 - 3. Accessories: Wire ball downspout strainer.
 - 4. Gutters with Girth 16 to 20 Inches: Fabricate from the following material:
 - a. Aluminum: Minimum of 0.040 inch thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: Minimum of 0.0276 inch thick (fka 24 gauge).
 - c. Prepainted, Metallic-Coated Steel: Minimum of 0.0276 inch thick (fka 24 gauge).
 - 5. Gutters with Girth 21 to 25 Inches: Fabricate from the following material:
 - a. Aluminum: Minimum of 0.050 inch thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: Minimum of 0.0336 inch thick (fka 22 gauge).
 - c. Prepainted, Metallic-Coated Steel: Minimum of 0.0336 inch thick (fka 22 gauge).
- B. Downspouts: Fabricate rectangular downspouts, unless otherwise noted, complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Manufactured Hanger Style: SMACNA Fig. 1-35B or Fig. 1-35H.
 - 2. Fabricate downspouts from the following material:
 - a. Aluminum: Minimum of 0.040 inch thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: Minimum of 0.0276 inch thick (fka 24 gauge).
 - c. Prepainted, Metallic-Coated Steel: Minimum of 0.0276 inch thick (fka 24 gauge).

2.8 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following material:
 - 1. Aluminum: Minimum of 0.0320 inch thick.
 - 2. Aluminum-Zinc Alloy-Coated Steel: Minimum of 0.0217 inch thick (fka 26 gauge).
 - 3. Prepainted, Metallic-Coated Steel: Minimum of 0.0217 inch thick (fka 26 gauge).
- B. Drip Edges: Fabricate from the following material:
 - 1. Aluminum: Minimum of 0.0320 inch thick.
 - 2. Aluminum-Zinc Alloy-Coated Steel: Minimum of 0.0217 inch thick (fka 26 gauge).
 - 3. Prepainted, Metallic-Coated Steel: Minimum of 0.0217 inch thick (fka 26 gauge).

- C. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following material:
 - 1. Aluminum: Minimum of 0.0320 inch thick.
 - 2. Aluminum-Zinc Alloy-Coated Steel: Minimum of 0.0217 inch thick (fka 26 gauge).
 - 3. Prepainted, Metallic-Coated Steel: Minimum of 0.0217 inch thick (fka 26 gauge).
- D. Base Flashing/Opening Flashing/Termination Flashing: Fabricate from the following material:
 - 1. Aluminum: Minimum of 0.040 inch thick.
 - 2. Aluminum-Zinc Alloy-Coated Steel: Minimum of 0.0276 inch thick (fka 24 gauge).
 - 3. Prepainted, Metallic-Coated Steel: Minimum of 0.0276 inch thick (fka 24 gauge).
- E. Open Valley Flashing: Fabricate in lengths not exceeding 10 feet with 1 inch high inverted "V" profile at center of valley and equal flange widths of 12 inches. Fabricate from the following material:
 - 1. Metal valley shall be a minimum of 24 inches wide.
 - 2. Aluminum: Minimum of 0.040 inch thick.
 - 3. Prepainted, Metallic-Coated Steel: Minimum of 0.0276 inch thick (fka 24 gauge).
 - 4. Add stiffening ribs in flashings to promote drainage.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following material:
 - 1. Stainless Steel: Minimum of 0.0187 inch thick.
- B. Miscellaneous Sheet Metal Flashing:
 - 1. Brake metal fascia trim and eave fascia trim.
 - a. Interlocking vertical joints. Joints shall provide means of expansion control.
 - b. Provide concealed splice plates with concealed fastening methods between sections of fascia trim.
 - c. Wrap wood blocking with sheet metal trim where indicated and provide concealed fasteners.
 - d. All corners shall be mitered, welded and ground smooth prior to finishing.
 - 2. Aluminum: Minimum of 0.040 inch thick.
 - 3. Aluminum-Zinc Alloy-Coated Steel: Minimum of 0.0276 inch thick (fka 24 gauge).
 - 4. Prepainted, Metallic-Coated Steel: Minimum of 0.0276 inch thick (fka 24 gauge).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 2. Verify compliance with requirements for installation tolerances of substrates.
 - 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.

3.2 INSTALLATION OF UNDERLAYMENT

- A. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
 - 1. Lap horizontal joints not less than 4 inches.
 - 2. Lap end joints not less than 12 inches.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Torch cutting of sheet metal flashing and trim is not permitted.
 2. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 3. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and butyl sealant.
 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - a. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 5. Do not use graphic pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
1. Coat side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - a. Exception: Bituminous coating is not required where stainless-steel sheet metal flashing is embedded in mortar.
 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of synthetic underlayment or Self-Adhered Sheet Underlayment.
 - a. Exception: Underlayment is not required where sheet-metal flashing is embedded in mortar.
 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
1. Use lapped expansion joints only where indicated on drawings.
- D. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails, not less than 3/4 inch for wood screws and not less than recommended by fastener manufacturer to achieve maximum pullout resistance.
- E. 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.
- F. Seal joints with butyl sealant as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.
 - 1. Do not solder prepainted, metallic-coated steel, and aluminum sheet.
 - 2. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
 - 3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.
- H. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.4 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA and NRCA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or [with lapped and riveted joints filled with butyl sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor then in position. Provide end closures and seal watertight with sealant. Slope to downspouts.
 - 1. Fasten gutter spacers as recommended by SMACNA (Fig. 1-13A) and NRCA and to meet local loading requirements, but not less and 36 inches apart.
 - 2. Anchor gutter with gutter brackets spaced not more than 36 inches apart, unless otherwise indicated (Fig. 1-13A).
 - a. Alternately space gutter spacers and stops.
 - 3. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.
- C. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide downspout brackets designed to hold downspouts securely 1 inch away from walls; locate downspout brackets at top and bottom and at approximately 60 inches o.c. in between.
 - 1. Connect downspouts to underground drainage system indicated.

3.5 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, and SMACNA's "Architectural Sheet Metal Manual" and NRCA's "The NRCA Roofing Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric or butyl sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
 - 1. Seal with butyl sealant and clamp flashing to pipes penetrating roof except for flashing on vent piping.

3.6 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.7 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with butyl sealant to equipment support member.

3.8 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 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 sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a 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.

END OF SECTION 07 62 00

SECTION 07 92 00 – JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes joint sealants for the applications indicated in the Joint-Sealant Schedule at the end of Part 3.
 - 1. Joint sealants, general.
 - a. Silicone joint sealants
 - b. Urethane joint sealants
 - c. Immersible joint sealants
 - d. Silyl-terminated polyether (STPE) joint sealants
 - e. Butyl joint sealants
 - f. Latex joint sealants
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for sealing of joints in slabs-on-grade or below grade.
 - 2. Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
 - 3. Division 08 Section "Glazing" for glazing sealants.
 - 4. Division 09 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
 - 5. Division 09 Section "Tiling" for sealing tile joints.
 - 6. Division 09 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.
 - 7. Division 32 Section "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. 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.
 - 1. Provide color charts to jobsite for selections by A/E representative.
 - 2. Do not submit color samples to A/E office.

1.4 CLOSEOUT SUBMITTALS:

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 - 1. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project, when required by terms of warranty.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

- D. 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. Refer to Division 04 Section "Unit Masonry" for additional mockup requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multiple-component materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 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.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
- B. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this section.

1.8 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 2 years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which silicone sealant manufacturer agrees to furnish silicone joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 5 years from date of Substantial Completion.
- C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
 - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 - 2. Disintegration of joint substrates from natural 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

2.1 MANUFACTURERS

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

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

2.3 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Liquid-Applied Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - 1. Suitability for Immersion in Liquids: Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- C. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.
- D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- E. Additional Movement Capability: Where additional movement capability is specified, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C920 for uses indicated.
- F. Colors of Exposed Joint Sealants: As selected by A/E from manufacturer's full range, unless otherwise noted.
 - 1. Provide tintable silicones where custom silicones are indicated.

2.4 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 790 or NS Parking Structure Sealant.
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - c. Pecora Corporation; 301 NS, 311 NS, 890NST, or 890FTS.
 - d. Sika Corporation; Sikasil WS-290 or Sikasil 728 NS.
 - e. Tremco Incorporated; Spectrem 1 or Spectrem 800.
- B. Single-Component, Nonsag, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 756 SMS, 791, 795, or 995.
 - b. GE Advanced Materials - Silicones; SilGlaze II SCS2800, SilPruf NB SCS9000, or SilPruf SCS2000.
 - c. Pecora Corporation; PCS.

- d. Polymeric Systems, Inc., Whitford Worldwide; PSI-641.
 - e. Sika Corporation; Sikasil WS-295 or Sikasil N+.
 - f. Tremco Incorporated; Spectrem 2 or 3.
- C. Multiple-Component, Nonsag, Silicone Joint Sealant: ASTM C920, Type M, Grade NS, Class 50, for Use NT.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; 890FTS-TXTR.
 - b. Sika Corporation; Sikasil WS-295 FPS.
 - c. Tremco Incorporated; Spectrem 4-TS.
- D. Single-Component, Nonsag, Traffic-Grade, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, for Use T.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 790 or NS Parking Structure Sealant.
 - b. Pecora Corporation; 301 NS or 311 NS.
 - c. Tremco Incorporated; Spectrem 800.
 - d. Sika Corporation; SikaSil 728 NS.
- E. Single-Component, Pourable, Traffic-Grade, Silicone Joint Sealant: ASTM C920, Type S, Grade P, Class 100/50, for Use T.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 890-SL or SL Parking Structure Sealant.
 - b. Pecora Corporation; 300 SL or 310 SL.
 - c. Tremco Incorporated; Spectrem 900 SL.
 - d. Sika Corporation; SikaSil 728 SL.
- F. Mildew-Resistant, Single-Component, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, for Use NT.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 786 Mildew Resistant.
 - b. GE Advanced Materials - Silicones; Sanitary SCS1700.
 - c. Tremco Incorporated; Tremsil 200 Sanitary.
 - d. Pecora Corporation; 898.
 - e. Sherwin-Williams; White Lightning Silicone Ultra Low Odor All Purpose Sealant.
 - f. Sika; Sikail-GP.

2.5 URETHANE JOINT SEALANTS

- A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 25 or 35, for Use NT.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolastic NP1, Sonolastic TX1, or Sonolastic Ultra.
 - b. Bostik, Inc.; Chem-Calk GPS1, 900, 915, or 916 Textured.
 - c. Pacific Polymers Division, ITW; Elasto-Thane 230.
 - d. Pecora Corporation; Dynatrol I-XL.
 - e. Polymeric Systems, Inc., Whitford Worldwide; Flexiprene 1000.
 - f. Sika Corporation, Construction Products Division; Sikaflex – 1A+ or Sikaflex Textured.
 - g. Tremco Incorporated; Dymonic, Dymonic FC, or Vulkem 116.
 - h. Henkel (fka OSI); EP-1000.
 - i. Sherwin-Williams; Stampede 1 Polyurethane Sealant.
- B. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C920. Type S, Grade NS, Class 25, for Use T.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolastic NP1 or Sonolastic Ultra.
 - b. Pacific Polymers Division, ITW; Elasto-Thane 230.
 - c. Sika Corporation, Construction Products Division; Sikaflex – 1A+.
 - d. Tremco Incorporated; Vulkem 116.
 - e. Sherwin-Williams; Stampede 1 Polyurethane Sealant.

- C. Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C920, Type S, Grade P, Class 25, for Use T.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolastic SL 1.
 - b. Bostik, Inc.; Chem-Calk 950.
 - c. Pecora Corporation; NR-201.
 - d. Polymeric Systems, Inc., Whitford Worldwide; Flexiprene PSI- 952.
 - e. Sika Corporation. Construction Products Division; Sikaflex-1CSL.
 - f. Tremco Incorporated; Vulkem 45.
 - g. Sherwin-Williams; Stampede 1SL Polyurethane Sealant.
- D. Multi-component, Nonsag, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use T.
 - 1. Products: Subject to compliance with requirements.
 - a. Pecora Corporation; Dynatrol II
 - 1) For traffic-grade applications, install per guidelines in manufacturer's technical bulletin.
 - b. Tremco Incorporated; Dymeric 240 or Dymeric 240 FC.
- E. Multi-component, Nonsag, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolastic NP 2.
 - b. Bostik, Inc.; Chem-Calk 500.
 - c. Pacific Polymers Division, ITW; Elasto-Thane 227 High Shore Type II, Elasto-Thane 227 R Type II or Elasto-Thane 227 Type II.
 - d. Pecora Corporation; Dynatred.
 - e. Sika Corporation, Construction Products Division; Sikaflex – 2c NS or Sikaflex – 2c NS EZ Mix.
 - f. Tremco Incorporated; Vulkem 227.
- F. Multi-component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use T.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolastic NP 2.
 - b. LymTal International, Inc.; Iso-Flex 885 SG.
 - c. Pacific Polymers Division, ITW; Elasto-Thane 227 High Shore Type II or Elasto-Thane 227 Type II.
 - d. Pecora Corporation; Dynatred.
 - e. Sika Corporation, Construction Products Division; Sikaflex – 2c NS or Sikaflex – 2c NS EZ TG.
 - f. Tremco Incorporated; Vulkem 227.

2.6 IMMERSIBLE JOINT SEALANT

- A. Immersible, Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, for Uses T and I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolastic NP1.
 - b. Sika Corporation, Construction Products Division; Sikaflex – 1a or Sikaflex 1A+.
 - c. Tremco Incorporated; Vulkem 116.
- B. Immersible Multi-component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Uses T and I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolastic NP 2.
 - b. LymTal International, Inc.; Iso-Flex 885 SG.
 - c. Sika Corporation; Sikaflex 2c NS.
 - d. Pecora Corporation; Dynatred.
 - e. Tremco Incorporated; Vulkem 227.

- C. Immersible Multi-component Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C920, Type M, Grade P, Class 25, for Use T and I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. LymTal International, Inc.; Iso-Flex 880 GB.
 - b. Sika Corporation; Sikaflex 2c SL.
 - c. Tremco Incorporated Vulkem 245.

2.7 SILYL-TERMINATED POLYETHER (STPE) JOINT SEALANTS

- A. STPE, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation-Construction Systems.
 - b. GE Construction Sealants; Momentive Performance Materials, Inc.
 - c. Pecora Corporation.
 - d. Sherwin-Williams Company.
 - e. Sika Corporation; Sika Hyflex 150LM.

2.8 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bostik, Inc.; Chem-Calk 300
 - b. Pecora Corp.; BC-158
 - c. Tremco Incorp.; General Purpose Butyl Sealant

2.9 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolac.
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. Pecora Corporation; AC-20+ Silicone.
 - d. Schnee-Morehead, Division, ITW; SM 8200.
 - e. Tremco Incorporated; Tremflex 834.
 - f. Sherwin-Williams; 950A Siliconized Acrylic Latex Caulk.
 - g. Franklin International; Titebond Kitchen and Bath Sealant
- B. Paintable Mildew-Resistant Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolac.
 - b. Pecora Corporation; AC-20+ Silicone.
 - c. Sherwin-Williams:
 - 1) Powerhouse 1110A Siliconized Acrylic Latex Sealant.
 - 2) White Lightning Kitchen and Bath Latex Ultra Sealant.
 - d. Tremco; Tremflex 834.

2.10 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell 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. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.11 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions 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, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish system.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.

- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 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.
 - 1. Mix and apply multi-component sealants in accordance with manufacturer's printed instructions.
 - 2. Apply joint sealants prior to applying penetrating water repellents. Joint sealants need to cure 7 days prior to application of penetrating masonry sealers.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
 - 1. Joints or gaps that require sealant are to be filled with one of the specified sealants even though the note may read "Caulked".
 - 2. Joints to be filled shall be thoroughly dry and free from dust, dirt, oil, and grease at the time of application of sealants.
 - 3. Expansion and control joints in exterior walls shall have the joint filler material built into the wall, or between wall and slab, at the time of construction.
 - 4. Masking: Metal shall be masked with masking tape, as well as other surfaces where it's required to prevent the sealant smearing the adjacent surface. Upon completion of the sealants, remove the tape.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces. Avoid "over-tooling" or "stretching" sealant material during application.
 - 3. Dry tool only, no wet tooling permitted.
 - 4. Provide concave joint profile per Figure 8A in ASTM C1193, unless otherwise indicated.
 - 5. Provide flush joint profile where indicated per Figure 8B in ASTM C1193.

6. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 1. Extent of Testing: Test completed and cured sealant for joints as follows:
 - a. Select joint sealants between multiple material types.
 - b. Initial Testing: One test for every 100 feet until 10 successive acceptable tests are completed.
 - c. Subsequent Testing: One test for every, 1000 feet with minimum one test for each building elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - a. 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.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 4. Record test results in field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application (JS-A): Exterior joints in vertical surfaces and non-traffic horizontal surfaces.
 1. Joint locations such as, but not limited to:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between architectural precast concrete units.
 - c. Control and expansion joints in unit masonry.

- 1) Provide joint sealants slightly darker than the adjacent masonry units. Provide multiple colors as may be required for match.
 - 2) Provide sealant over expanding foam secondary sealant where a 2 inch building expansion joint is indicated.
 - d. Joints in dimensional stone cladding, limestone, and cast stone.
 - e. Joints in glass unit masonry assemblies.
 - f. Perimeter joints between masonry, concrete, or stone and frames of doors, windows, storefronts, louvers, and similar openings.
 - g. Lintels and shelf angles to masonry construction.
 - h. Bed joints between stone and masonry.
 - i. Butt joints between metal panels.
 - j. Joints in exterior insulation and finish systems.
 - k. Control and expansion joints in ceiling/soffit and similar overhead surfaces.
 - l. Exterior joints between dissimilar materials where the joining of the two surfaces leaves a gap between the meeting materials or components as may be dictated by various methods of construction to make building watertight.
 - m. Other joints as indicated on Drawings.
 2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
 - a. Neutral-Curing Silicone Joint Sealant:
 - 1) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 100/50, for Use NT.
 - 2) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
 - 3) Multi-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
 3. Color: Custom color to match A/E's sample of adjacent materials.
- B. Joint-Sealant Application (JS-B): Exterior joints in horizontal traffic surfaces.
1. Joint locations such as, but not limited to:
 - a. Control and expansion joints in brick pavers.
 - b. Isolation and contraction joints in cast-in-place concrete slabs.
 - c. Joints between plant-precast architectural concrete paving units.
 - d. Joints in stone paving units.
 - e. Tile control and expansion joints.
 - f. Joints between different materials listed above.
 - g. Other joints as indicated on Drawings.
 2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
 - a. Neutral-Curing Silicone Joint Sealant:
 - 1) Single-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 100/50, for Use T.
 - 2) Single-Component, Pourable, Traffic-Grade: ASTM C920, Type S, Grade P, Class 100/50, for Use T.
 - b. Urethane Sealant:
 - 1) Single-Component, Pourable, Traffic-Grade: ASTM C920, Type S, Grade P, Class 25, for Use T.
 - 2) Multi-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade P, Class 50, for Use T.
 - 3) Multi-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade P, Class 25, for Use T.
 3. Color: As selected by A/E from manufacturer's full range of colors.
- C. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion (JS-C).
1. Joint locations:
 - a. Joints in pedestrian plazas.
 - b. Other joints as indicated.

2. Immersible Urethane Joint Sealant:
 - a. Single-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 25, for Use T and I.
 - b. Multi-Component, Nonsag, Traffic-Grade: ASTM C920, Type M, Grade NS, Class 25, for Use T and I,
 - c. Multi-Component, Pourable, Traffic-Grade: ASTM C920, Type M, Grade P, Class 25, for Use T and I.
- D. Joint-Sealant Application (JS-D): Interior joints in horizontal traffic surfaces.
1. Joint locations such as, but not limited to:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Perimeter of floor slabs or concrete curbs which abut vertical surfaces.
 - c. Areas around all piping systems that penetrate the slab or foundation walls below grade (utility trenches, electrical conduits, plumbing penetrations, etc.).
 - d. Control and expansion joints in tile flooring.
 - e. Other joints as indicated on Drawings.
 2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
 - a. Neutral-Curing Silicone Joint Sealant: Single-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 100/50, for Use T.
 - b. Urethane Joint Sealant:
 - 1) Single-Component, Pourable, Traffic-Grade: ASTM C920, Type S, Grade P, Class 25, for Use T.
 - 2) Multi-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade P, Class 50, for Use T.
 - 3) Multi-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade P, Class 25, for Use T.
 3. Color: As selected by A/E from manufacturer's full range of colors.
- E. Joint-Sealant Application (JS-E): Interior joints in vertical surfaces and horizontal non-traffic surfaces, subject to movement, unless otherwise noted.
1. Joint locations such as, but not limited to:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Joints in precast beams and planks, including underside.
 - c. Interior joints where interior partitions meet exterior walls of dissimilar materials and components.
 - d. Other joints as indicated on Drawings.
 2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated.
 - a. Urethane Joint Sealant:
 - 1) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 25 or 35, for Use NT.
 - 2) Multi-Component, Nonsag: ASTM C920, Type M, Grade NS, Class 25, for Use NT.
 - b. Silyl-Terminated Polyester
 - 1) Single-Component, STPE, S, NS, 50, NT.
 3. Color: Custom to match A/E's sample.
- F. Joint-Sealant Application (JS-F): Interior joints in vertical surfaces subject to abuse and movement.
1. Joint locations such as, but not limited to:
 - a. Vertical joints, including control joints and joints between masonry and structural support members, on exposed surfaces of interior unit masonry walls and partitions.
 2. Provide the following acceptable sealants as approved by manufacturer for substrates and use indicated:
 - a. Urethane Joint Sealant: Single-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 25, for Use T.
 3. Color: Custom to match A/E's sample.

- G. Joint-Sealant Application (JS-G): Interior joints in vertical surfaces not subject to movement.
1. Joint locations such as, but not limited to:
 - a. Interior perimeter joints of exterior openings.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - c. Interior joints between dissimilar materials where a gap is created where materials meet, unless otherwise noted.
 2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
 - a. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
 3. Color: As selected by A/E from manufacturer's full range.
- H. Joint-Sealant Application (JS-H): Mildew-resistant interior joints in non-painted vertical surfaces and horizontal nontraffic surfaces.
1. Joint locations such as, but not limited to:
 - a. Interior joints between plumbing fixtures and adjoining floors and counters.
 - b. Joints between countertops and backsplashes.
 - c. For interior joints in non-painted vertical and horizontal surfaces where incidental food contact may occur.
 - d. Tile control and expansion joints where indicated.
 - e. Other joints as indicated on Drawings.
 2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
 - a. Mildew-Resistant, Single-Component, Acid-Curing, or Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, for Use NT.
 - 1) For potable water storage sealant shall be certified by National Sanitation Foundation as conforming to the requirements of NSF Standard 61 – Drinking Water System Components – Health Effect.
 - 2) For surfaces where incidental food contact may occur sealant must comply with United States Department of Agriculture (USDA) guidelines for incidental food contact with cured sealant.
 3. Color: As selected by A/E from manufacturer's full range of colors.
- I. Joint-Sealant Application (JS-K): Mildew-resistant interior joints in painted vertical surfaces and horizontal non-traffic surfaces.
1. Joint locations such as, but not limited to:
 - a. Interior joints between plumbing fixtures and adjoining painted walls.
 - b. Joints where countertops or backsplashes intersect painted walls.
 - c. For interior joints in painted vertical and horizontal surfaces where incidental food contact may occur.
 2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
 - a. Mildew-Resistant Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
 3. Color: As selected by A/E from manufacturer's full range of colors.
- J. Joint-Sealant Application (JS-I): Interior or exterior joints in vertical surfaces between laps in fabrications of sheet metal.
1. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
 - a. Urethane Joint Sealant:
 - 1) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 25 or 35, for Use NT.
 - 2) Single-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 25, for Use T.
 2. Color: Not applicable.

- K. Joint-Sealant Application (JS-J): Exterior joints under metal thresholds and saddles, sill plates, or as bedding sealant for sheet metal flashing and frames of metal or wood.
1. Provide one of the following acceptable sealants as approved by manufacturer for substrates and use indicated.
 - a. Neutral-Curing Silicone Joint Sealant:
 - 1) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 100/50, for Use NT.
 - 2) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
 - 3) Multi-Component, Nonsag: ASTM C920, Type M, Grade NS, Class 50, for Use NT.
 - b. Urethane Joint Sealant:
 - 1) Single-Component, Nonsag: ASTM C920, Type S, Grade NS, Class 25 or 35, for Use NT.
 - 2) Single-Component, Nonsag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 25, for Use T.
 - c. Butyl-rubber based sealant.
 2. Color: Not applicable.

END OF SECTION 07 92 00

08

DIVISION

OPENINGS

SECTION 08 12 13 - HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hollow metal frames
 - 2. Borrowed lites
- B. Furnish materials and equipment necessary for complete installation by the following Sections:
 - 1. Division 04 Section "Unit Masonry": For installing anchors in masonry construction.
- C. Coordination: Refer to Division 08 Section "Glazing" to obtain glass thickness requirements. Provide properly sized stops and bead to house the specified glass according to the glass manufacturer's recommendations and as indicated.
- D. Related Sections:
 - 1. Division 07 Section "Joint Sealants": For caulking between metal frames and adjacent materials.
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 08 Section "Door Hardware" for coordination.
 - 4. Division 08 Section "Glazing".
 - 5. Division 09 Section Interior Painting.
 - 6. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.
 - a. Exception: Low-voltage wiring for security/access control and for automatic door operator switches is pulled by the Division 28 ("Electronic Safety and Security") security/access control contractor.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI A250.8.

1.3 COORDINATION

- A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of frame specified, including details of construction, materials, dimensions, hardware preparation, fire-resistance ratings, label compliance, and finishes.
- B. Shop Drawings:
 - 1. Provide schedule of frames using same reference numbers for details and openings as those on Contract Drawings and Schedules.
 - 2. Elevations of each door frame type.
 - 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 frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on drawings. Coordinate with door hardware schedule.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver frames cardboard wrapped or crated to provide protection during transit and job storage.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store frames at building site under cover. Place units on minimum 4 inch high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. Provide minimum 1/4 inch space between each stacked door to permit air circulation.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.
- B. Door Size Field-Verification: Contractor/Frame Supplier shall note that the door sizes as listed on the door schedule, for new frames in existing openings, are approximate and are for bidding purposes only. The Contractor/Frame Supplier MUST field verify door size, frame preps, and other frame conditions prior to submission of Shop Drawings and fabrication of frames. It will be assumed, by the A/E, that the door size as indicated on the Shop Drawings has been field-verified by the Contractor/Frame Supplier. Frames shipped to the Project site that are incorrect size for the existing opening shall be the responsibility of the Contractor/Frame Supplier to replace at no additional cost to the Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - a. Ceco Door Products; Div. of Assa-Abloy Group Company
 - b. Steelcraft; Div. of Ingersoll-Rand
 - c. Curries; Div. of Assa-Abloy Group Company
 - d. Mesker Door Inc.
 - e. The MPI Group, LLC
 - f. Deansteel Manufacturing Company
 - g. Security Metal Products.
 - h. Door Components, Inc.
 - i. Pioneer Industries
 - j. Republic Doors and Frames.

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Openings shall be provided to conform with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. Where openings, in the opinion of the supplier/manufacturer, do not conform, the A/E shall be notified.
- B. Smoke Control Door Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL1784 and installed in compliance with NFPA 105.

2.3 MATERIALS

- A. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A1008, Drawing Steel, Type B; stretcher-leveled standard of flatness.
- B. Frame Anchors: ASTM A879, Commercial Steel (CS), 40z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel complying with ASTM A 1008A or ASTM A 1011, hot-dip galvanized according to ASTM A 153, Class B.
- C. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot dip zinc coated items to be built into exterior walls, complying with ASTM A153, Class C or D as applicable.
- D. Shop Applied Paint: For steel surfaces, use rust-inhibitive enamel or paint, either air drying or baking, suitable as a base for specified finish paints.
 - 1. Comply with ANSI A250.10 for acceptance criteria.
- E. Glazing: Comply with requirements in Division 08 Section "Glazing."
- F. Mineral Fiber Insulation: ASTM C 665, Type 1 (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with a 6 to 16 pounds per cubic foot density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- G. Corrosion-Resistant Coating: Spray-applied rubber- or asphalt-based automotive undercoating.

2.4 FRAME TYPES

- A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
- B. Frames for interior door openings and borrowed lights shall be fabricated with 2 inch face at jambs, heads and mullions, unless otherwise indicated.
 - 1. 0.053 inch thick (fka 16 gauge) steel, cold rolled, factory applied baked on primer, for Level 2 and Level 3 steel doors and wood doors.
 - 2. 0.067 inch thick (fka 14 gauge) steel, cold rolled factory applied baked on primer, for Level 4 doors (provide at steel-framed partitions).
 - 3. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - 4. Construction: Full profile welded, unless otherwise noted.
 - 5. Exposed Finish: Prime.

- C. Full Profile Welded Frames: Frames for masonry and steel stud and drywall construction shall be mitered or butted and set-up and welded, "SUW", with welds on exposed surfaces, dressed smooth and flush. Provide a temporary spreader bar securely fastened to the bottom of each frame. Butt welded frames without back bend at head and jamb joint will not be acceptable.

2.5 FRAME ASSEMBLIES

- A. Stops and Beads: Furnish minimum 0.032 inch thick (fka 20 gauge) sheet steel glazing beads with the hollow metal frames at transoms, side lights, interior glazed panels, and other locations where beads are indicated in pressed steel frames. Glazing beads for exterior frames shall be on the interior side of transoms and sidelights. Glazing beads for interior frames shall be located on the secure side of opening.
- B. Mortar/Plaster Guards: Provide minimum 0.016 inch thick (fka 26 gauge) steel plaster guards or mortar boxes, welded to the frame, at back of door hardware cutouts where mortar or other materials might obstruct hardware operation.
- C. Provide minimum 0.1495 inch thick (fka 9 MSG) hinge reinforcement, including all doors with continuous-type hinges.
- D. Provide minimum 0.1046 inch thick (fka 12 MSG) frame head reinforcement for closers, surface, and concealed overhead stop and holders, removable mullions, flush bolts, and top latch of vertical rod exit devices.
- E. Door Silencers: Drill stops and install 3 silencers on strike jambs of single swing frames and 2 silencers on heads of double swing frames.
- F. Hollow metal frames requiring continuous gear hinges or pin-and-barrel hinges shall have a continuous mortar guard of foam or cardboard by the frame height, applied with construction adhesive or a minimum 0.016-inch thick (fka 26 gauge) steel, welded to frame, the full height of the door. Mortar guards shall be shop applied by frame supplier.
- G. Frames installed in masonry shall be furnished with a field-or-shop applied corrosion-resistant coating the full depth of the frame.

2.6 BORROWED LITES

- A. Fabricate of minimum thickness of 0.053 inch of the following:
 - 1. Interior: Uncoated steel sheet.
- B. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles and each joints, fabricated of metal of same or greater thickness as metal as frames.
- C. Provide countersunk, flat-or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.7 FRAME ANCHORAGE

- A. Wall, Floor, and Head Anchors
 - 1. Frames Set in New Masonry: Provide metal anchors of shapes and sizes required for the adjoining wall construction. Provide a minimum of 3 wall anchors per jamb. Frames over 7'-6" shall be provided with one additional anchor for each 24 inch or fraction thereof.
 - a. Provide adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inches thick (fka 18 gauge), with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch in diameter (fka 7 WMG).

2. Frames Set Against Previously Placed Masonry or Concrete: Punch each frame jamb and dimple countersink for not less than four 3/8 inch diameter flat head screws. For doors over 7'-6" high, punch for one additional anchor for each 24 inches or fraction thereof. Provide pipe sleeves with spacers welded into each jamb at each fastening location. Provide 3/8 inch diameter galvanized steel flat head screws with approved expansion anchors or toggles as required. After installing flat head screws, fill head of countersink screw with body filler, then sand flush with frame.
3. Frames Set in Wood Stud Construction
 - a. Studs Erected with Frame: Provide a minimum of three 0.042-inch (fka 18 gauge), metallic coated, welded-in, jamb anchors in each jamb. For doors over 7'-6" high provide one additional anchor for each 24 inches or fraction thereof. Bend anchor tabs around stud leaving clearance between frame return and stud for inserting wall material.
 - b. Slip-On Drywall Frames: Provide field adjustable compression anchors in each jamb and adjustable base anchors per manufacturer's recommendations.
4. Provide head anchors at door or window heads over 5 feet wide at minimum 3 feet o.c.
5. Provide 0.067 inch thick (fka 14 gauge) minimum angle shaped floor clips welded to jambs and punched for two 3/8 inch diameter bolts each.
6. Provide adjustable length clip angles as required.

2.8 FABRICATION

- A. Fabricate steel door frame units to comply with ANSI A250.8 and be rigid, neat in appearance, and free from defects, warp, or buckle. Accurately form metal to required sizes and profiles. Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at the Project site.
- B. Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either cold rolled or hot rolled steel (at fabricator's option).
- C. Clearances for Non-Fire Rated Doors: Not to exceed 1/8 inch at jambs and heads, 3/32 inch between pairs of doors, and 3/4 inch at bottom.
- D. Clearances for Fire Rated Doors: As required by NFPA 80.
- E. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- F. Exposed fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.
- G. Door Hardware Preparation: Factory prepare hollow-metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 1. Prepare hollow metal units to receive mortised and concealed door hardware, including cutouts, steel reinforcing, drilling, and tapping in accordance with final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A250.6 and ANSI/BHMA A156.115 for preparation of hollow-metal work for hardware.
 2. Reinforce hollow metal units to receive nontemplated, mortised, and surface mounted hardware. Hardware installer shall drill and tap for surface applied hardware.
- H. Stops and Moldings: Manufacturer's standard, formed from minimum 0.032 inch thick (fka 20 gauge) steel sheet stops and moldings around glazed lites and louvers. Form corners of stops and moldings with butted or mitered hairline joints.
 1. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 2. Provide fixed frame moldings on outside of exterior and on secure side of interior frames. Provide loose stops and moldings on inside of hollow-metal 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-headed machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.9 STEEL FINISHES

- A. General: Comply with recommendations in "Metal Finishes Manual" by Architectural and Metal Products Division of National Association of Architectural Metal Manufacturers (NAAMM) for applying and designating finishes.
 1. Finish standard steel frames after assembly.
- B. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning".
- C. Factory Priming for Field Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.
 1. Shop Primer: Manufacturer's standard, fast curing, lead and chromate free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field applied finish paint system indicated; and providing a sound foundation for field applied topcoats despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel frames.
 1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory prior to setting frames. Restore exposed finish by grinding, fitting, 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. Prior to installation and with Contractor-installed installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 2. Alignment: Plus or minus 1/16 inch, measured on jambs on a horizontal line parallel to plane of wall.
 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install steel frames and accessories according to shop drawings, manufacturer's data, and as specified.
- B. Standard Steel Frames: Install standard steel frames for doors, sidelights, transoms, borrowed lights, and other openings, of size and profile indicated. Comply with ANSI A250.11 or NAAMM HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire protection rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections due to shipping or handling limitations, field-splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field-apply corrosion-resistant coating to backs of frames that are installed in masonry or concrete walls, where coating has not been shop applied. coverage rate, or in the case of automotive undercoating, to a minimum 1/8-inch thickness.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullions that extends to floor and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on shop drawings.
 - 3. Stud Partitions: Solidly pack mineral fiber insulation behind frames.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout as specified in Division 04 Section "Unit Masonry."
 - a. Where grout is installed during masonry installation, frames shall be braced or fastened in such a way that will prevent the pressure of the grout from deforming the frame members. Grout shall be mixed to provide a 4 inch maximum slump consistency, hand troweled into place. Grout mixed to a thin "pumpable" consistency shall not be used.
 - 1) Refer to ANSI A 250.8 for additional information.
 - 5. Existing Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 6. Existing Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 7. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with standard steel frame manufacturer's written instructions.
 - 1. Secure stops with countersunk flat or oval head machine screws spaced uniformly not more than 9 inches on center, and not more than 2 inches on center from each corner.

3.4 FIELD QUALITY CONTROL

- A. Frames
 - 1. Install plumb, level and true to line, secured in openings.
 - 2. Install frames in accordance with accepted shop drawings, manufacturer's printed instructions.
- B. Final Adjustment: Doors and hardware shall receive final adjustment as follows:
 - 1. Door Contact with Silencers: Single doors shall strike a minimum of two silencers without binding lock or latch bolts in the strike plate.
 - 2. Head, Strike and Hinge Jamb Margin: 1/8 inch.
 - 3. Meeting Edge Clearance, Pairs of Doors: . 1/8 inch plus-or-minus 1/16 inch
 - 4. Bolts and Screws: Leave tight and firmly seated.
 - 5. Fire-Resistance Rated Doors: Install with clearances per NFPA 80.
 - 6. Smoke-Control Doors: Install with clearances per NFPA 105.
- C. Warped, bowed, or damaged work will be rejected and shall be replaced with new work.
- D. Check and readjust operating hardware items immediately before final inspection.
- E. Leave work in a complete and proper operating condition.

3.5 CLEANING

- A. Clean grout and other bonding material off standard steel frames immediately after installation.
- B. Prime Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air drying primer.

3.6 PROTECTION

- A. After installation, protect frames from damage during subsequent construction activities.

END OF SECTION 08 12 13

SECTION 08 13 16.16 - FLUSH ALUMINUM DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Flush aluminum doors.
 - 1. Hardware for flush aluminum doors will be furnished under Division 08 Section "Door Hardware".
- B. Related Sections:
 - 1. Division 07 Section "Joint Sealants": For sealant between aluminum frames and adjacent materials.
 - 2. Division 08 Section "Aluminum-Framed Entrance and Storefront Framing".
 - 3. Division 08 Section "Door Hardware" for coordination.

1.2 DEFINITIONS

- A. Definitions: For fenestration industry standard terminology and definition refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA-AG).

1.3 PRE-INSTALLATION MEETING:

- A. A general orientation meeting shall be attended by the following:
 - 1. Storefront framing contractor
 - 2. Hardware supplier
 - 3. Hardware installer
 - 4. Electrical contractor
 - 5. Security contractor
 - 6. Automatic door operator installer
 - 7. General trades contractor
 - 8. Construction Manager
 - 9. A/E's and Owner's representative
- B. Agenda
 - 1. Review of installation procedures related to the schedules of hardware, doors, and frames. Review the wiring diagrams for related electronic hardware and connection to the security access system and intended function.
 - 2. Agenda
 - a. Review and finalize construction schedule.
 - b. Review code and project performance compliance documentation and testing requirements including product certification for energy (U-value, SHGC), ADA, etc.
 - c. Review means and methods related to installation, including manufacturer's written instructions.
 - d. Examine support conditions for compliance with requirements including alignment and attachment to structural members.
 - e. Review flashings, openings, and conditions of other construction affecting this work.
 - f. Review temporary protection requirements for during and after installation of this work.

1.4 ACTION SUBMITTALS

- A. Product Data: For each product specified, including details of construction relative to materials, dimensions of individual components, profiles, finishes, anchorage and fasteners, glazing, and internal drainage.
 - 1. Energy Performance Certificates: For aluminum doors from manufacturer.
 - a. Basis for Certification: NFRC-certified energy performance values for each aluminum door type.

- B. Shop Drawings: Show elevations of each door type, door construction details and methods of assembling sections, hardware locations and installation methods, dimensions, and shapes of materials, anchorage and fastening methods, weatherstripping, and finish requirements. Drawings must show actual wall conditions.
 - 1. Provide schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings and Schedules.
- C. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1.5 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 - 1. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
 - 2. Warranties: Special warranties specified in this Section.

1.6 MAINTENANCE

- A. Entrance Door Hardware:
 - 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.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer and supervisor who has specialized in installing flush aluminum door similar to those required for this Project and who is acceptable to manufacturers.
- B. Regulatory Requirements: Doors shall be provided to conform with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. Where openings, in the opinion of the supplier/manufacturer, do not conform the A/E shall be notified.
- C. 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, alignments, 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 A/E, except with A/E's approval. If changes are proposed, submit comprehensive explanatory data to A/E for review.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Materials to be packed, loaded, shipped, unloaded, stored and protected in accordance with AAMA C101-10.
- B. Do not used adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of this Work to be performed according to manufacturer's installation instructions and warranty requirements.
 - 1. Install sealant according to sealant manufacturer guidelines.

- B. Field Measurements: Check openings by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the work.

1.10 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Deterioration of metals, metal finishes unless special finish warranty is required, and other materials beyond normal weathering.
 - d. Water leakage through fixed glazing and framing areas.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to where to bare metal.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
 - 3. Warranty covers factory-applied finishes on exposed extruded aluminum surfaces without standing water accumulation, against peeling, checking, cracking, checking and change of color, per applicable AAMA specifications.

1.11 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - a. Tubelite Inc. (Tubelite) a subsidiary of Apogee Framing Systems
 - b. Cross Aluminum Products (Cross)
 - c. EFCO Corporation (EFCO) a subsidiary of Apogee Framing Systems
 - d. Manko Window Systems Inc. (Manko)
 - e. Special-Lite, Inc.
 - f. U.S. Aluminum Division, CR Laurence Co. (CRL).
 - g. YKK AP America Inc. (YKK)
 - h. Oldcastle Building Envelope
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

1.12 PERFORMANCE REQUIREMENTS

- A. Refer to Division 08 Section "Aluminum-Framed Entrances and Storefront Framing" for additional "Opening" requirements.
- B. General: Provide flush aluminum doors capable of withstanding loads and thermal and structural movement requirements without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

- C. Design Wind Loads
 - 1. Wind Loads: As indicated on Drawings.
 - 2. The design wind pressure for the project will be:
 - a. 20 psf positive and negative, unless otherwise noted.
 - 1) Provide a minimum 25 psf negative at corner zones.
 - b. Per local building codes.
- D. Structural: Test according to ASTM E330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites of glass to 3/4 inch whichever is smaller.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Performance Requirements: Exterior entrance doors
 - 1. Air Infiltration Test: With door sash closed and locked, test unit in accordance with ASTM E283 or NFRC 400 at a static air pressure difference of 1.57 psf.
 - a. Air infiltration shall not exceed .50 cfm/SF of unit, for a single door.
 - b. Air infiltration shall not exceed 1.0 cfm/SF of unit, for a pair of doors.
 - 2. Water Penetration under Static Pressure: Test according to ASTM E331 and as follows:
 - a. 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.
- F. Energy Performance: Certify and label energy performance according to NFRC as follows:
 - 1. Thermal Transmittance (U-factor): Thermally-improved doors shall have U-factor at not more than 0.70 Btu/sq.ft. x h x deg F.
 - 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
 - 3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC certified condensation resistance rating at no less than 45 as determined according to NFRC 500.

1.13 FLUSH ALUMINUM DOORS

- A. Doors: Manufacturer's standard flush aluminum doors, for manual swing operation.
 - 1. Provide minimum 1-3/4-inch-thick doors constructed from the following materials:
 - a. Framing and Hardware Backup: Extruded aluminum tubing, 0.125 inch minimum thickness.
 - b. Facing; provide one of the following:
 - 1) Seamless aluminum sheet 0.062 inch thick ribbed texture, laminated to 0.125-inch tempered hardboard.
 - 2) Seamless aluminum sheet 0.090 inch thick ribbed texture.
 - 2. Core: Rigid insulating material of not less than 2.0 lb./cu.ft. density.
 - 3. Exterior stops shall be an integral part of the door construction with a minimum wall thickness of .132 inch and a minimum height of 3/4 inch. Glazing tape shall be applied to stop prior to installation of glass or panel. Doors shall be interior glazed with 3/4-inch-high extruded aluminum snap-in glass stops with a minimum wall thickness of 0.060 inch with a roll-in gasket.
 - 4. Reinforce doors as required for installing hardware.
 - a. At pair of exterior doors, provide sliding weather retained in adjustable strip mortised into door edge.
 - b. At exterior doors, provide weather sweeps applied to door bottoms.
 - 5. Where aluminum doors are scheduled to receive a concealed overhead stop, the jamb bracket shall be mortised into the frame and the channel mortised into the top of the door. The cut for the arm on the stop side of the door shall not be cut below the stop strip of the frame.

- B. Where ADA compliant threshold is scheduled, provide door with door bottom sweeps and undercut door as required for weathertight seal. Verify type threshold with door hardware schedule.
- C. Weatherstripping: Manufacturer's replaceable components used as tested for air infiltration, water penetration, and thermal "performance requirements".

1.14 DOOR AND WINDOW FRAMING MATERIALS AND CONSTRUCTION

- A. Refer to Division 08 Section "Aluminum-Framed Entrance and Storefront Framing".

1.15 HARDWARE

- A. For balance of hardware furnished by others, refer to Division 08 Section "Door Hardware".

1.16 FINISH

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within 1/2 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.
- C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- D. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturer's written instructions.
 - 1. Color and Gloss: Black.

PART 2 - EXECUTION

2.1 EXAMINATION

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

2.2 PREPARATION

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.
 - 1. Aluminum Surface Protection: Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

2.3 INSTALLATION

- A. Flush aluminum doors shall be securely installed according to the manufacturer's recommendations, and operating hardware shall be checked for proper function and adjustment.
 - 1. Adjust weatherstripping contact and hardware movement to produce proper operation.
- B. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturer's written instructions.
 - 1. Field-Installed Entrance Door Hardware: Install surface mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.
 - 2. Exterior Doors: Install to produce weathertight enclosure and tight fit at weatherstripping.
- C. Refer to Division 08 Section "Aluminum-Framed Entrances and Storefronts".
- D. Do not cut aluminum frame stop strip when mounting exit devices and closers.
- E. Where aluminum doors are scheduled to receive a concealed overhead stop, the jamb bracket shall be mortised into the frame and the channel mortised into the top of the door. The cut for the arm on the stop side of the door shall not be cut below the stop strip of the frame.

2.4 ADJUSTING AND CLEANING

- A. Adjust doors and hardware to provide tight fit at contact points and weatherstripping, smooth operation, and weathertight closure.
 - 1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70 degree open position to 3 inches from the latch measured to the leading door edge.
- B. Cleaning: Comply with AAMA 609 and 610 for methods, equipment, and materials to clean finished aluminum after installation.
- C. Remove excess sealant and glazing compounds, and dirt from surfaces.

2.5 PROTECTION

- A. Protect the flush aluminum doors and their finish against damage from construction activities and harmful substances. Clean the aluminum surfaces as recommended for the type of finish applied.

END OF SECTION 08 13 16.16

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Five-ply flush wood veneer-faced doors for transparent finish.
 - 2. Factory-preparation of wood doors for hardware specified in Division 08 Section "Door Hardware".
 - 3. Doors shall be factory-finished, unless otherwise noted.
 - 4. Factory-fitting flush wood doors to frames.
 - 5. Factory-glazing.
 - 6. Full-glass full-warranty doors.
- B. Related Sections:
 - 1. Division 08 Section "Hollow Metal Frames".
 - 2. Division 08 Section "Door Hardware" for coordination.
 - 3. Division 08 Section "Glazing".

1.2 ACTION SUBMITTALS

- A. Product Data: Submit door manufacturer's product data, specifications, and installation instructions for each type of wood door, including door construction description and WDMA I.S.1-A and AWS classifications.
 - 1. Include details of core and stile construction, trim for openings and louvers (if any), and similar components.
 - 2. Include factory-finishing specifications.
- B. Shop Drawings: Indicate locations, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
 - 1. Door schedule indicating door location, type, size, fire protection rating, and swing.
 - 2. Door elevations, dimension, and locations of hardware, lite and louver cutouts, and glazing thickness.
 - 3. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 4. Dimensions and locations of blocking for hardware attachment.
 - 5. Dimensions and locations of mortises and holes for hardware.
 - 6. Undercuts and clearances.
 - 7. Requirements for veneer matching.
 - 8. Doors to be factory finished and finish requirements.
 - 9. Include details of sound control seals.
- C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
 - 1. Faces of Factory-Finished Doors: Show the full range of colors available for stained and opaque finishes.

1.3 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 - 1. Cleaning Instructions: Submit manufacturer's cleaning instructions for doors.
 - 2. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Comply with the applicable requirements of the following standards unless otherwise indicated:
 - 1. ANSI/WDMA I.S. 1, "Industry Standard for Wood Flush Doors," published by Window and Door Manufacturers Association (WDMA), formerly the National Wood Window and Door Association (NWWDA).
- B. Openings shall be provided to conform to the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. Where, in the opinion of the supplier/manufacturer, openings do not conform, notify the A/E.
- C. Composite wood products shall be labeled or show compliance with the Toxic Substances Control Act (TSCA) Title VI.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect wood doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced ANSI standard and recommendations of WDMA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors," as well as with manufacturer's instructions.
- B. Identify each door with individual opening numbers that correlate with designation system used on shop drawings for door, frames, and hardware, and STC or fire rating where applicable, using temporary, removable, or concealed markings.
- C. Polybag protect each door for shipment and handling.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with requirements of the referenced quality standard for Project's geographical location.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, installer, and contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42 by 84 inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3 inch span.
 - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 2. Warranty shall be in effect during the following period of time from date of Substantial Completion.
 - a. Interior Solid-Core Interior Doors: Full Life of Original Installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - a. Masonite Architectural
 - b. Lambton Doors
 - c. Oregon Door
 - d. Oshkosh Door Company
 - e. VT Industries, Inc.
 - f. Wilsonart LLC

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Manufacturer: Obtain doors from a single manufacturer to ensure uniformity in quality of appearance and construction.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors".
 - 1. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- C. Smoke-and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- D. Particleboard-Core Doors:
 - 1. Particleboard: ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde resin.
 - 2. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices, light openings, or louvers.
- E. Structural-Composite-Lumber-Core Doors:
 - 1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf (3100 N).
 - b. Screw Withdrawal, Edge: 400 lbf (1780 N).
- F. Mineral-Core Doors:
 - 1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 - 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
 - a. Two 4-1/2-by-10-inch lock blocks or 5-inch mid-rail blocking, in doors indicated to have exit devices.
 - 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split-resistance. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors, General:
 - 1. Grade: Custom (Grade A faces).
 - 2. Species: Red oak.
 - 3. Cut: Plain sliced (flat sliced).
 - 4. Match between Veneer Leaves: Slip match.
 - 5. Assembly of Veneer Leaves on Door Faces: Running match.
 - 6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 - 7. Exposed Vertical Edges: Applied wood (veneered or solid) edges of same species as faces and covering edges of crossbands-edge Type B or D.

8. Core:
 - a. Doors without Exit Devices, Light Openings, or Louvers: Provide particle board core (PC), unless otherwise noted.
 - b. Doors with Exit Devices, Doors with Light Openings and Doors with Louvers (and where otherwise noted): Provide structural composite lumber core (SCLC).
 - 1) Lock-to-lite-cutout shall not be less than 1 1/2 inches.
9. Construction: Five plies. Stiles and rails are bonded to core, then abrasive-plane entire unit before veneering. Faces are bonded to core using a hot press.
 - a. Seven plies will not be acceptable.
- B. Provide approved and labeled wood fire doors at locations indicated in Door Schedule. Approved doors, frames, and hardware shall be constructed and installed in accordance with requirements of NFPA 80 and tested by Underwriters' Laboratories, Inc. (UL) or Warnock Hersey (WH) for the class of door opening indicated in schedules.
- C. Nonrated and 20 Minute Rated Full-Glass Full-Warranty Doors:
 1. Provide faces and grade to match doors as specified first paragraph of this Article.
 2. Core Construction: Engineered Hardwood Composite Lumber (LSL) Core.
 3. Door Thickness: 1-3/4 inch.
 4. Core/Edge Innerface: Bonded.
 5. Top rail and vertical stiles shall be a minimum 6 inches wide and bottom rail shall be a minimum of 10 inches wide.
 6. Lock-to-Lite Cutout (minimum): 1-1/2 inch.
 7. Stile and Rail Edges:
 - a. Top and Bottom Rails: Mill-option hardwood.
 - b. Vertical Stiles: Provide veneered edges to conceal crossband edges.

2.4 GLAZING

- A. Factory Glazing:
 1. Nonrated doors shall be glazed with 1/4 inch thick clear tempered safety glass, unless otherwise noted.
 - a. Provide fire-rated, sound-rated and security glass, where indicated.
 2. Door supplier shall provide wood stops for nonrated and 20-minute doors. Stop shall be flush with face veneer; recessed stops will not be acceptable.
 3. For labeled wood doors to receive glass, door supplier shall provide manufacturer's standard frame formed of 0.0478inch (fka 18 gauge) cold-rolled steel, low-profile (maximum 3/32-inches high), veneer wrapped with same species as door face veneer, and approved for use in door of fire rating indicated.

2.5 LOUVERS AND LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.
 1. Wood Species: Same species as door faces.
 2. Profile: Flush rectangular beads.
 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

2.6 PREFITTING AND PREPARATION FOR HARDWARE

- A. Prefit and pre-machine wood doors at factory, including beveling both edges 1/8 inch in 2 inches. Where pairs of doors are scheduled, prefit and pre-machine as pairs. Where pairs of doors are scheduled with 3 point latching (lockset and flush bolts), the strike edge of the inactive leaf shall be square equal to WDMA meeting edge option E1.

- B. Rated and nonrated doors shall comply with tolerance requirements of NFPA 80 for pre-fitting. Machine doors for hardware requiring cutting of doors. Comply with final hardware schedules and door frame shop drawings and with hardware templates and other essential information required to ensure proper fit of doors and hardware.
 - 1. Top and hinge edges: 1/8 inch maximum.
 - 2. Single door, lock edge: 1/8 inch maximum.
 - 3. Pair meeting edge: 1/16 inch per leaf maximum.
 - 4. Bottom (rated or nonrated):
 - a. 1/2 inch from decorative floor covering.
 - b. 3/4 inch maximum from top of noncombustible floor.
 - c. 3/8 inch maximum from top of noncombustible sill or threshold.
 - d. Doors with vertical rod exit devices, manual or automatic flush bolts shall be undercut for latching of bolts to a flush floor strike or threshold.
 - e. See Division 09 Section "Room Finish Schedule", for floor finish materials.
- C. Coordinate with the metal frame supplier the locations of hardware mortises in metal frames to verify dimensions and alignment before proceeding with machining in factory.
- D. Factory-machine doors for hardware that is not surface-applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame, shop drawings, DHI A115-W series standards, and hardware templates.

2.7 FABRICATION

- A. General:
 - 1. The utility or structural strength of the doors must not be impaired in fitting to the opening in applying hardware, in preparing for lights, louvers, plant-ons or other detailing.
 - 2. Pilot holes must be drilled for all screws that act as hardware attachments. Threaded-to-the-head screws are preferable for fastening hardware to nonrated doors and are required on fire-rated doors.
 - 3. In fitting for height, do not trim top or bottom edge by more than 3/4 inch, unless accommodated by additional blocking. Do not trim top edge of fire doors.
- B. Factory-fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 1. Comply with clearance requirements of referenced quality standard for fitting, unless otherwise indicated.
 - 2. Comply with requirements in NFPA 80 for fire-rated doors.
- C. Factory-machine doors for hardware that is not surface-applied.
 - 1. Locate hardware to comply with DHI-WDHS-3.
 - 2. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 - 3. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory-machining.
 - 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
 - 5. Metal Astragals: Factory-machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- D. Openings: Cut and trim openings through doors in factory.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory-install glazing in doors indicated to be factory-finished. Comply with applicable requirements in Division 08 Section "Glazing."

2.8 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory-finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface-applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory, unless specifically noted otherwise.
- C. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: WDMA TR-6 catalyzed polyurethane or TR-8 UV cured acrylated.
 - 3. Staining: As selected by A/E from manufacturer's full range.
 - 4. Effect: Open-grain finish.
 - 5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Ensure frames are solidly anchored, allowing no deflection when doors are installed.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware".
- B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
 - 1. Install smoke-and draft-control doors according to NFPA 105.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 3/8 inch from bottom of door to top of threshold.
 - a. Comply with NFPA 80 for fire-rated doors.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

3.4 CLEANING

- A. Clean doors promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

3.5 PROTECTION

- A. Protect installed doors from damage during construction.

END OF SECTION 08 14 16

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Access doors and frames for walls and ceilings.
- B. Related Sections include the following:
 - 1. Division 04 Section "Unit Masonry" for anchoring and grouting access door frames set in masonry construction.
 - 2. Division 09 Section "Gypsum Board Assemblies" for anchoring access door frames set in gypsum board construction.

1.2 COORDINATION

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

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical data for each type of access door and panel assembly, including setting drawings, templates, fire-resistive characteristics, finish requirements, and details of anchorage devices.
 - 1. Include complete schedule, type, locations, construction details, finishes, latching or locking provisions, and other pertinent data.

1.4 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 - 1. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.
- B. Size Variations: Obtain A/E's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acudor Products, Inc.
 - 2. Babcock-Davis.
 - 3. Cendrex Inc.
 - 4. Elmdor/Stoneman Manufacturing Co.; Div. of Acorn Engineering Co.
 - 5. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
 - 6. Karp Associates, Inc.
 - 7. Lane-Aire Manufacturing Corp.
 - 8. Larsen's Manufacturing Company.
 - 9. Maxam Metal Products Limited.
 - 10. Metropolitan Door Industries Corp.

11. MIFAB, Inc.
 12. Milcor Inc.
 13. Nystrom, Inc.
 14. Williams Bros. Corporation of America (The).
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Flush Access Doors with Exposed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
 2. Locations: Wall.
 3. Door Size: 24 inches by 24 inches, unless otherwise noted.
 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gauge.
 - a. Finish: Factory prime.
 5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gauge.
 - a. Finish: Factory prime.
 6. Frame Material: Same material, thickness, and finish as door.
 7. Hinges: Manufacturer's standard.
 8. Hardware: Latch.
- D. Flush Access Doors with Concealed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
 2. Locations: Wall and ceiling.
 3. Door Size: 24 inches by 24 inches, unless otherwise noted.
 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gauge.
 - a. Finish: Factory prime.
 5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gauge.
 - a. Finish: Factory prime.
 6. Frame Material: Same material and thickness as door.
 7. Hinges: Manufacturer's standard.
 8. Hardware: Latch.
- E. Fire-Rated, Flush Access Doors with Exposed Flanges:
1. Basis-of-Design Product: Indicated on Drawings Babcock Davis Insulated Fire-Rated Access Door.
 2. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
 3. Locations: Ceiling.
 4. Size: 20 inches by 40 inches, minimum.
 5. Fire-Resistance Rating: 1.5 hours.
 6. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch, 20 gauge.
 - a. Finish: Factory primed.
 7. Frame Material: Same material, thickness, and finish as door.
 8. Hinges: Manufacturer's standard continuous piano hinge.
 9. Hardware: Latch.
- F. Hardware:
1. Latch: Cam latch operated by screwdriver or by flush key.

2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879, with cold-rolled steel sheet substrate complying with ASTM A 1008, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A 653, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- D. Frame Anchors: Same type as door face.
- E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329.

2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
 - 2. Provide mounting holes in frames for attachment of units to metal or wood framing.
 - 3. Provide mounting holes in frame for attachment of masonry anchors.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

2.4 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Steel and Metallic-Coated-Steel Finishes:
 - 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that rough openings for door and frame are correctly sized and located.
 - 2. Verify mechanical and electrical requirements for ceiling or wall access panels.

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

3.2 PREPARATION

- A. Advise installers of other work about specific requirements relating to access door installation, including size of openings to receive access door and frame, as well as locations of supports, insert, and anchoring devices. Furnish inserts and anchoring devices for access doors that must be built into other construction. Coordinate delivery with other work to avoid delay.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
 - 1. Install frames plumb and level in opening. Secure rigidly in place.
 - 2. Position units to provide convenient access to concealed work requiring access.
 - 3. Fire-rated units: Include UL or Warnock-Hersey labels.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.4 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum-framed storefront systems.
 - a. Provide framing for Aluminum-framed entrance doors and Flush Aluminum Doors systems.
 - 2. Aluminum-framed entrance door system.
- B. Related Sections:
 - 1. Division 07 Section "Joint Sealants": For sealant between aluminum frames and adjacent materials.
 - 2. Division 08 Section "Door Hardware".
 - 3. Division 08 Section "Glazing": For glazing requirements.

1.2 PREINSTALLATION MEETINGS

- A. A general orientation meeting shall be attended by the following:
 - 1. Storefront framing contractor
 - 2. Hardware supplier
 - 3. Hardware installer
 - 4. Electrical contractor
 - 5. Security contractor
 - 6. Automatic door operator installer
 - 7. General contractor
 - 8. Construction Manager
 - 9. A/E's and Owner's representative
- B. Review of installation procedures related to the schedules of hardware, doors, and frames. Review the wiring diagrams for related electronic hardware and connection to the security access system and intended function.

1.3 ACTION SUBMITTALS

- A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.
 - 1. Energy Performance Certificates: For aluminum-framed entrances and storefront framings accessories and components, from manufacturer.
 - a. Provide an NFRC Component Modeling Approach (CMA) generated label certificate shall be provided by the manufacturer. The label certificate shall be project specific and will contain the thermal performance ratings of the manufacturer's framing combined with specified glass and glass spacer used in the fabrication of the glass, at NFRC standard test size as defined in table 4-3 in NFRC 100-2010.
 - 2. Glazing: Submit manufacturer's technical data for each glass type and glazing material required to comply with Energy Performance criteria. Refer to Division 08 Section "Glazing" for specific glazing requirements.
 - a. Performance charts indicating performance values required to comply with total opening energy performance.
 - b. Documentation for solar-control low-e coated glass demonstrating that glazing manufacturer of coated glass is certified by coating manufacturer.
 - 3. Qualification Data: For installers and engineers.
 - a. For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the state in which Project is located

- B. Shop Drawings: For entrance and storefront systems. Show details of fabrication and installation, including plans, elevations, sections, and details of components, provisions for expansion and contraction, and attachments to other work. Drawings must show actual wall conditions.
 - 1. Indicate member sizes and reinforcement necessary to meet performance requirements and support hardware.
 - 2. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 3. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - 4. Transition Details: Include three-dimensional isometric drawings of the frame illustrating how the frame will interface with the transition strip associated with the air barrier in the masonry cavity. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
 - 5. 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: Color samples approximately 8 inches by 8 inches on aluminum.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- B. Warranties: Special warranties specified in this Section.

1.5 MAINTENANCE

- A. Entrance Door Hardware
 - 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.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer and supervisor who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to 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 and Metal (AG and M) contractors.
- B. Regulatory Requirements
 - 1. Accessible Entrances: Conform to the U.S. Architectural & Transportation Barriers Compliance Board's, "Americans with Disabilities Act Accessibility Guidelines" (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.
 - a. Opening-Force Requirements:
 - 1) Egress Doors: Not more than 30 lbf required to set door in motion and not more than 15 lbf required to open door to minimum required width.
 - 2) Accessible Interior Doors: Not more than 5 lbf.

- C. Product Options: Information on all Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignments, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjacent construction.
 - 1. Do not change intended aesthetic effects, as judged solely by A/E, except with A/E's approval. If changes are proposed, submit comprehensive explanatory data to A/E for review.
- D. Mockups: Building mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. First installation of aluminum-framed entrances and storefronts, including glazing may serve as mockup. Coordinate location with A/E.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless A/E 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.

1.7 FIELD CONDITIONS

- A. Field Measurements: Check openings by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the work.

1.8 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Deterioration of metals, metal finishes (unless special finish warranty is required), and other materials beyond normal weathering.
 - d. Water leakage through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to where to bare metal.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing, spandrel panels, venting windows, and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "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 manufacturer, fabrication, installation, or other defects in construction.
 - 1. Aluminum-framed entrances shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Glazing: Physically and thermally isolate glazing from framing members.
- D. Wind Design Loads
 - 1. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding wind load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," "6.5, Method 2 - Analytical Procedure," whichever are more stringent.
 - a. Refer to Structural Drawings.
 - 2. Per local building codes, but never less than 20 psf positive and negative or 25 psf negative in corner zones.
- E. Deflection of Framing Members: At design wind pressure, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
 - 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing tile 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. Cantilever Deflection: Limited to 2L/175 at unsupported cantilevers:
- F. Structural: Test according to ASTM E330 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.

- G. Air Infiltration: Test according to ASTM E283 or NFRC 400 for infiltration as follows:
1. Fixed Framing and Glass Area
 - a. Maximum air leakage of 0.06 cfm/sq.ft. at a static-air-pressure differential of 1.57 lbf/sq.ft..
 2. Entrance Doors
 - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq.ft. at a static-air-pressure differential of 1.57 lbf/sq.ft.
 - b. Single Doors: Maximum air leakage of 0.5 cfm/sq.ft. at a static-air-pressure differential of 1.57 lbf/sq.ft.
- H. 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.
- I. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor):
 - a. Type III (Thermally Broken): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq.ft. x h x deg F as determined according to NFRC 100.
 2. Solar Heat Gain Coefficient:
 - a. Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
 - b. Entrance Doors: SHGC of not more than 0.40 as determined in accordance with NFRC 200.
 3. Condensation Resistance:
 - a. Fixed glazing and framing areas shall have a NFRC-certified condensation resistance rating of no less than 56 as determined according to NFRC 500.
 - b. Entrance Doors: CRF of not less than 68 as determined in accordance with AAMA 1503.
- J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F., ambient; 180 deg F., material surfaces.
- K. Dimensional Tolerances: Provide window and storefront systems that accommodate dimensional tolerances of building frame and other work.

2.3 MATERIAL

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below:
1. Sheet and Plate: ASTM B209.
 2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B221.
 3. Extruded Structural Pipe and Tubes: ASTM B429.
 4. Bars, Rods, and Wire: ASTM B211.
 5. Welding Rods and Bare Electrodes: AWS A5.10.
 6. Structural Profiles: ASTM B308.
- B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC Standard.
1. Structural Shapes, Plates, and Bars: ASTM A 36.
 2. Cold-Rolled Sheet and Strip: ASTM A 1008.
 3. Hot-Rolled Sheet and Strip: ASTM A 1011.

- C. Steel Reinforcement Primer: Manufacturers 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.
- D. Glazing as specified in Division 08 Section "Glazing".
- E. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.
- F. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.
- G. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.
- H. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Division 07 Section "Joint Sealants".
 - 1. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other system components with which it comes in contact; and recommended by sealant and aluminum-framed system manufacturer for this use.
- I. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30 mil thickness per coat.

2.4 FRAMING SYSTEM

- A. Framing members, transition members, mullions, adapters, and mountings (including sill anchors, frame receptors at jambs, and other frame trim and accessories shown on Drawings), shall be extruded aluminum with alloy and temper consistent with the method of manufacturer.
 - 1. Framing members shall be of thickness required and reinforced as required to support imposed loads.
 - 2. Construction: Where indicated, members shall incorporate a thermal-barrier by one of the following methods:
 - a. Framing members shall be composite assemblies of two separate extruded-aluminum components permanently bonded by an elastomeric material of low thermal conductance.
 - 3. Fabrication Method: Field-fabricated stick system or unitized as recommended by fabricator for application indicated.
 - 4. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 5. Steel Reinforcement: As required by manufacturer to meet Performance Requirements.
 - a. Required for spans exceeding structural performance requirements. Increase in depth dimension is also acceptable to comply with span and loading requirements.
 - b. Reinforcement may be required for storefront assembly at entrance.
- B. Type I – 1-3/4 by 4-1/2 inch. Framing members shall provide for flush center glazing of 1/4 inch glass, by use of elastomeric gaskets on both sides of the glass, with no projecting stops. Vertical and horizontal framing members shall have a nominal face dimension of 1-3/4 inches with an overall depth of 4-1/2 inches. Entrance framing members shall be compatible with glass framing in appearance.

1. Manufacturers: Subject to compliance with requirements, provide one of the manufacturers specified:
 - a. System 400 (NT); EFCO Corporation
 - b. Trifab VG 450; Kawneer Co.
 - c. 450 Series; Manko Window Systems, Inc.
 - d. SL-450; Special-Lite, Inc.
 - e. YES 45; YKK AP America
 - f. 450 Series; U.S. Aluminum Div. of CRL
 - g. Oldcastle Building Envelope
 - h. Tubelite
 - i. Cross Aluminum Products
 2. Application for framing type
 - a. Interior vestibule doors.
 - b. Interior storefront system (no doors).
 - c. Interior storefront system with doors, sidelights and transoms.
- C. Type III – 2 by 4-1/2 inch with thermal barrier. Framing members shall provide for flush center glazing of one inch insulating glass, by use of elastomeric gaskets on both sides of the glass, with no projecting stops. Framing members shall incorporate a thermal barrier. Vertical and horizontal framing members shall have a nominal face dimension of 2 inches with an overall depth of 4-1/2 inches. Door entrance frames shall include weatherstripping.
1. Manufacturers: Subject to compliance with requirements, provide one of the manufacturers specified:
 - a. System 403 Thermal; EFCO Corporation
 - b. Trifab VG 451T; Kawneer Co.
 - c. 2450 Series; Manko Window Systems, Inc.
 - d. T 14000; Tubelite
 - e. YES 45TU; YKK AP America
 - f. IT451 Series; U.S. Aluminum Div. of CRL
 - g. Series 3000 Thermal MultiPlane; Oldcastle Building Envelope (OBE)
 - h. Cross Aluminum Products
 - i. Special-Lite, Inc.
 2. Application for framing type
 - a. Entries with multiple sidelights or transoms.
 - b. Exterior doors without sidelights or transoms.
 - c. Exterior storefront system (punched openings).
 3. Where indicated with increased span height requirement, provide 2 inch by 6 inch center set storefront system, similar to Oldcastle Building Envelope 6000 Series.
- D. Where indicated on Drawings, provide deeper frame profile. Face width shall remain the same.
- 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.
- G. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 2. Reinforce members as required to receive fastener threads.
 - a. Provide a backup reinforcement, at door frame head, of steel or 1/4 inch aluminum for attachment of closer arm.
 - b. All members less than 0.125 inch thick to receive threaded fasteners shall receive backup reinforcement.

- H. Anchors: Three way adjustable anchors with minimum adjacent of 1 inch that accommodate fabrication and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.
 - 2. Select anchors and connections based on existing opening conditions. Conditions may vary throughout building. Anchors shall remain concealed or covered by additional aluminum trim components.
- I. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.
- J. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.
 - 1. Sills: Provide formed or extruded sills as indicated on Drawings, 0.125 inch thick aluminum in same finish as the framing members.
 - 2. Exterior closure flashings, closure angle, and closure trim shall be 0.063 inch thick aluminum in same finish as the framing members.
 - a. This includes but is not limited to corner closures, aluminum closure trim and closures adjacent to existing construction.
 - 3. Interior Trim, Closures and Angles: As detailed, of extruded or formed shapes no less than 0.063 inch nominal wall thickness.
- K. Vertical mullions between doors shall have steel reinforcement and be attached to the floor with concealed fasteners.
- L. Subsills: Thermally broken, extruded-aluminum subsills.
 - 1. Provide at all locations where other extended sills are not indicated.

2.5 ENTRANCE DOOR SYSTEMS

- A. Stile and Rail Design: Wide stile, nominally 5–inch wide vertical stiles, 6-1/2–inch high top rail, intermediate rail, and nominally 10–inch high bottom rail.
 - 1. Series 550 (modified top and bottom rail and door muntin): U.S. Aluminum Division of CRL.
 - 2. WS-500-HD (modified top and bottom rail and intermediate rail): Cross.
 - 3. Series D500 (modified top and bottom rail) and mid-rail: EFCO.
 - 4. 500 (modified top and bottom rail) and intermediate rail: Kawneer.
 - 5. Series 150 (modified top and bottom rail and mid-rail): Manko.
 - 6. Series SL-15 (modified top and bottom rail and intermediate rail): Special-Lite, Inc.
 - 7. Wide Stile (modified top and bottom rail and intermediate rail): Tubelite.
 - 8. 50D Wide Stile (modified top and bottom rail and intermediate rail): YKK.
 - 9. WS-500 Wide Stile: Oldcastle Building Envelope.
- B. Sections shall be extruded from 6063-T5 aluminum alloy (ASTM B221 Alloy GS 10A T5).
- C. Major portions of the door stiles shall be 0.125 inch in thickness, and glazing molding shall be 0.050 inch thick.
 - 1. Mullions shall be as detailed on Drawings and as required for type of door being furnished.
 - 2. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.
 - 3. Glazing Stops and Gaskets: Square, snap-on, extruded aluminum stops and preformed gaskets of neoprene bulb type.
 - a. Provide lock-in tamperproof type glazing stops on outside of door.
 - b. No exposed screws shall be required to secure stops.

- D. Screws, miscellaneous fastening devices, and internal components shall be of stainless steel, plated, or corrosion-resistant materials of sufficient strength to perform the functions for which they are used.
- E. Wide Stile: Corner construction shall consist of both sigma deep penetration and sigma fillet welds and mechanical fastening. Inside joints between the top rail and vertical stiles shall have a continuous bead of sealant. Interior glazing stops shall be square snap-in type with neoprene bulb type glazing. Square stops on exterior side shall be lock-in tamperproof type. No exposed screws shall be required to secure stops.
- F. Weathering: Manufacturer's replaceable components used as tested for air-infiltration, water penetration and thermal "Performance Requirements".
- G. Where ADA-compliant threshold is scheduled, provide door with door bottom sweeps and undercut door as required for weathertight seal. Verify type threshold with door hardware schedule.
- H. Doors shall have the lockstile portion of the top rail closed for mounting security door contacts.
- I. Where aluminum doors are scheduled to receive a concealed overhead stop, the jamb bracket shall be mortised into the frame and the channel mortised into the top of the door. The cut for the arm on the stop side of the door shall not be cut below the stop strip of the frame.

2.6 HARDWARE

- A. Refer to Division Section "Door Hardware", unless otherwise noted.
- B. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Mode of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
- C. Weather Sweeps: Manufacturer's standard exterior door bottom sweep with concealed fasteners on mounting strip.
- D. Silencers: BHMA A156.16, Grade 1.

2.7 FABRICATION

- A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
 - 4. Physical and thermal isolation of glazing from framing members.
 - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - a. Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual".
 - 6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or panels.
 - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 - 8. Where aluminum will contact dissimilar metals, protect against galvanic action.
 - 9. Provide manufacturer's standard profiles for special conditions:
- B. Form or extrude aluminum shapes before finishing.

- C. 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.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).
- E. Storefront Framing: Fabricate components for assembly using screw-spline system or head and sill receptor system with shear blocks at intermediate horizontal members.
 - 1. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.
- F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.
 - 1. At exterior and interior doors, provide compression weather stripping at fixed stops.
 - 2. Provide subframes and reinforcing of types indicated or, if not indicated, as required for complete system.
 - 3. Where aluminum doors are scheduled to receive a concealed overhead stop, the jamb bracket shall be mortised into the frame and the channel mortised into the top of the door. The cut for the arm on the stop side of the door shall not be cut below the stop strip of the frame.
 - 4. Provide weather sweeps applied to door bottoms.
- G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- H. After fabrication, clearly mark components to identify their locations in Project according to shop drawings.

2.8 FINISH

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within 1/2 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.
- C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- D. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturer's written instructions.
 - 1. Color and Gloss: As selected by A/E from coating manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

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

3.2 PREPARATION

- A. Openings for aluminum entrances and storefronts shall be prepared to the proper size, plumb, square, level, and in the proper location and alignment as shown on the Drawings and the final shop drawings.
 - 1. Coordinate with masonry tolerances. Refer to Division 04 Section "Unit Masonry".

3.3 INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
 - 1. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 2. Shim and brace aluminum system before anchoring to structure.
 - 3. Provide sill flashing at exterior storefront systems. Extend extruded flashing continuous with splice joints; set in continuous beads of sealant.
 - 4. Verify storefront system allows water entering system to be collected in gutters and wept to exterior.
 - 5. Locate expansion mullions where indicated on reviewed shop drawings.
 - 6. Seal perimeter and other joints watertight, unless otherwise indicated.
 - a. Do not seal weeps.
- B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
 - 1. Provide end dams at all sill terminations.
- D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 07 Section "Joint Sealants".
 - 1. To minimize the potential for water leakage attributed to the subsill, fastener penetrations through the horizontal leg of the subsill should be avoided. Instead, brackets that engage the subsill without penetrating the wet zone should be mechanically attached to the subsill extrusion and fully sealed to ensure a watertight interface.
- E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.
- F. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.
 - 1. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.
- G. Install glazing to comply with requirements of Division 08 Section "Glazing", unless otherwise indicated.
 - 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.

- H. Install perimeter sealant to comply with requirements of Division 07 Section "Joint Sealants", unless otherwise indicated.
- I. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surface abut in line or are separated by a reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.
- J. Do not cut aluminum frame stop strip when mounting exit devices and closers.
- K. Coordinate with Division 08, Division 26, and security access contractor for location and installation of conduit/wiring required for electrified hardware items mounted to doors and frames, including, but not limited to, cutting/drilling any access holes required for pulling wires through frame head/jambs to the electrified hardware items.

3.4 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 of weatherstripping.

3.5 ADJUSTING AND CLEANING

- A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.
 - 1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.
- B. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.6 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08 41 13

SECTION 08 56 00 - SPECIAL FUNCTION WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes; Special function windows of the following types:
 - 1. Transaction (service) windows.
- B. Related Sections:
 - 1. Division 08 Section "Glazing".

1.2 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for windows.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachments details.
 - 2. Full-size section details of framing members, including reinforcement and stiffeners.
 - 3. Location of weep holes.
 - 4. Sliding hardware for transaction windows.
 - 5. Glazing details.
 - 6. Details of transaction counter.
- C. Samples for Initial Selection: For frame members with factory-applied color finishes.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Pack windows in wood crates for shipment. Crate glazing separate from frames unless factory glazed.
- B. Store crated windows on raised blocks to prevent moisture damage.

1.4 FIELD CONDITIONS

- A. Field Measurements: Verify transaction window openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.5 SEQUENCING

- A. Coordinate installation of anchorages for windows. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Creative Industries
 - 2. Ready Access Pass Thru Windows
 - 3. Quickserv Corp.

4. Nissen and Company, Inc.
5. C.R. Laurence Co., Inc.

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221. Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000 psi ultimate tensile strength and not less than 0.125 inch thick at any location for main frame and sash members.
- B. Steel Plates, Shapes, and Bars: ASTM A 36.
- C. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
- D. Bituminous Paint: Cold-applied, asphalt mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos; formulated for 30 mil thickness per coat.

2.3 WINDOW COMPONENTS

- A. Glazing: 1/4 inch glass, laminated, complying with ANSI Z97.1, ASTM C 1036 and ASTM C 1048 and "Federal CPSC Standard 16 CFR 1201 Category II."
- B. Compression Type Glazing Strips and Weather Stripping: Unless otherwise indicated, provide compressible stripping for glazing and weather stripping such as molded EPDM or neoprene gaskets complying with ASTM D 2000, Designation 2BC415 to 3BC620, or molded PVC gaskets complying with ASTM D 2287; or molded, expanded EPDM or neoprene gaskets complying with ASTM C 509, Grade 4.
- C. Miscellaneous Glazing Materials: Provide material, size, and shape complying with requirements of glass manufacturers; and with a proven record of compatibility with surfaces contacted in installation.
 1. Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.
 2. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85 plus or minus 5.
 3. Spacers: Elastomeric blocks or continuous extrusions with a Type A Shore durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 4. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- D. Anchors, Clips, and Window Accessories: Stainless steel, hot dip zinc coated steel or iron complying with ASTM B 633; provide sufficient strength to withstand design pressure indicated.

2.4 HORIZONTAL-SLIDING, TRANSACTION WINDOWS (INTERIOR)

- A. Basis of Design Product: C.R. Laurence Inc.: CRL Daisy Model Pass-Thru Window or a comparable product of one of the listed manufacturers.
- B. Configuration and Size: As indicated on Drawings.

- C. Framing: Fabricate perimeter framing, and glazing stops from metal sheet as follows:
 - 1. Material: Extruded aluminum with one of manufacturer's standard finish, unless otherwise noted.
 - 2. Profile: Manufacturer's standard with minimum face dimension indicated.
 - 3. Framing Depth:
 - a. Manufacturer's standard.
 - 4. Overhead Track: Manufacturer's D6 track.
 - 5. Jamb framing required.
 - 6. Spring load sill guide. No bottom track required.
- D. Sliding Window Hardware: Provide roller track designed for overhead support of two or four wheel carriage supporting horizontal sliding glazed panel. Provide manufacturer's standard pull and keyed lock for each horizontal sliding glazed panel.

2.5 FABRICATION

- A. General: Fabricate windows to comply with indicated standards. Include a complete system for assembly of components and anchorage of windows.
 - 1. Provide windows that are reglazable from the secure side without dismantling the nonsecure side of framing.
 - 2. Prepare windows for glazing unless preglazing at the factory is indicated.
- B. Framing: Miter or cope corners the full depth of framing, weld, and dress smooth.
- C. Glazing Stops: Finish glazing stops to match window framing.
 - 1. Secure Side (Exterior) Glazing Stops: Welded or integral to framing.
 - 2. Nonsecure Side (Interior) Glazing Stops: Removable, coordinated with glazing indicated.
- D. Welding: Weld components to comply with referenced AWS standard. To greatest extent possible weld before finishing and in concealed locations to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- E. Metal Protection: Separate dissimilar metals to protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- F. Preglazed Fabrication: Preglaze windows at the factory where possible and practical for applications indicated.
- G. Weather Stripping: Factory applied.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: 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.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

- B. Class II, Anodic Finish: AA-M12C22A31 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of transaction windows.
 - 1. Examine roughing in for embedded and built in anchors to verify actual locations of transaction window connections before transaction window installation.
 - 2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of transaction windows.
- B. Inspect built in and cast in anchor installations, before installing transaction windows, to verify that anchor installations comply with requirements. Prepare inspection reports.
 - 1. Remove and replace anchors where inspections indicate that they do not comply with specified requirements. Reinspect after repairs or replacements are made.
 - 2. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Fastening to In Place Construction: Provide anchorage devices and fasteners where necessary for securing transaction windows to in place construction. Include threaded fasteners for inserts, transaction fasteners, and other connectors.
 - 1. Provide acceptable fasteners for installation within storefront framing system.
 - 2. Coordinate with adjacent countertop installation for recessing of bottom track elements.
- B. Sealants: Comply with requirements in Division 7 Section "Joint Sealants" for installing sealants, fillers, and gaskets.
 - 1. Seal frame perimeter with sealant to provide weathertight construction, unless otherwise indicated.
- C. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.3 ADJUSTING

- A. Adjust horizontal sliding transaction windows to provide a tight fit at contact points, for smooth operation and a secure enclosure.
- B. Remove and replace defective work, including windows that are warped, bowed, or otherwise unacceptable.

3.4 CLEANING

- A. Clean surfaces promptly after installation of transaction windows. Exercise care to avoid damaging the finish. Remove excess glazing and sealant compounds, dirt, and other substances.
 - 1. Lubricate sliding window hardware.
- B. Clean glass of preglazed transaction windows promptly after installation of transaction windows.

END OF SECTION 08 56 00

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

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

C. Related Sections:

1. Division 01 Section "Alternates" for alternates affecting this section.
2. Division 06 Section "Rough Carpentry"
3. Division 06 Section "Finish Carpentry"
4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:
 - a. "Metal Doors and Frames"
 - b. "Flush Wood Doors"
 - c. "Aluminum Doors and Frames"
6. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
7. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL - Underwriters Laboratories

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

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA - National Fire Protection Association

1. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
2. NFPA 101 – Life Safety Code
3. NFPA 105 – Smoke and Draft Control Door Assemblies
4. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
 - a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
 - b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule:
 - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.

- b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
 - c. Indicate complete designations of each item required for each opening, include:
 - 1) Door Index: door number, heading number, and Architect's hardware set number.
 - 2) Quantity, type, style, function, size, and finish of each hardware item.
 - 3) Name and manufacturer of each item.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each hardware set cross-referenced to indications on Drawings.
 - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for hardware.
 - 8) Door and frame sizes and materials.
 - 9) Degree of door swing and handing.
 - 10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.
5. Key Schedule:
- a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
 - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
 - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.

C. Informational Submittals:

- 1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
- 2. Provide Product Data:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - b. Include warranties for specified door hardware.

D. Closeout Submittals:

- 1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Final approved hardware schedule edited to reflect conditions as installed.
 - d. Final keying schedule
 - e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

- f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

- 1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
 - a. fire door assemblies, in compliance with NFPA 80.
 - b. required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

- 1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
- 2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
- 3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 - a. For door hardware: DHI certified AHC or DHC.
 - b. Can provide installation and technical data to Architect and other related subcontractors.
 - c. Can inspect and verify components are in working order upon completion of installation.
 - d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.
- 4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

- 1. Fire-Rated Door Openings:
 - a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
 - b. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- 2. Smoke and Draft Control Door Assemblies:
 - a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
 - b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware
 - a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
 4. Accessibility Requirements:
 - a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.
- C. Pre-Installation Meetings
1. Keying Conference
 - a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2) Preliminary key system schematic diagram.
 - 3) Requirements for key control system.
 - 4) Requirements for access control.
 - 5) Address for delivery of keys.
 2. Pre-installation Conference
 - 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.
 - f. Review questions or concerns related to proper installation and adjustment of door hardware.
 3. Electrified Hardware Coordination Conference:
 - a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
 - 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
 - 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
 - a. Mechanical Warranty
 - 1) Locks: 10 Years
 - 2) Exit Devices: 10 Years
 - 3) Closers: 30 Years
 - b. Electrical Warranty
 - 1) Electric Locks: 3 Years
 - 2) Electric Exit Devices: 3 Years

1.08 MAINTENANCE

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
 - 1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

- A. Fasteners
 - 1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
 - 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 - 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru bolts are required.
 - 4. Install hardware with fasteners provided by hardware manufacturer.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
 - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 HINGES

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Ives 5BB series

2. Acceptable Manufacturers and Products:

- a. Hager BB series
- b. McKinney TA/T4A series

B. Requirements:

- 1. Provide hinges conforming to ANSI/BHMA A156.1.
- 2. Provide five knuckle, ball bearing hinges.
- 3. Hinge Height:
 - a. 1-3/4 inch (44 mm) thick doors up to 36 inches (914 mm) wide: 4-1/2 inches (114 mm) high
 - b. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide: 4-1/2 inches (114 mm) high
 - c. 2 inches or thicker doors: 5 inches (127 mm) high, regardless of door width
- 4. Hinge width: 4-1/2 inches (114 mm) wide typical. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
- 5. Hinge quantity: Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
- 6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins

2.04 CONTINUOUS HINGES, ALUMINUM, GEARED

A. Manufacturers:

- 1. Scheduled Manufacturer:
 - a. Ives
- 2. Acceptable Manufacturers:
 - a. Select
 - b. Hager

B. Requirements:

- 1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
- 2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
- 3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
- 4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
- 5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
- 6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
- 7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin EPT-10
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage L9000 series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches. Provide motor based electrified and motor based latch retraction locksets that comply with the following requirements:
 - a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
 - b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case
 - c. Low maximum current draw – maximum 0.4 amps (Lever control) and maximum 2.0 amps (Latch retraction) to allow for multiple locks on a single power supply.

- d. Low holding current (Lever control or latch retraction) – maximum 0.01 amps to produce minimal heat, eliminate “hot levers” in electrically locked applications and motorized latch retraction applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
 - e. Connections – provide quick-connect Molex system standard.
- 8. (OPTION Key Override) Provide locks with a key override feature built into the chassis that allows the outside key to retract the deadbolt and/or latchbolt, overriding the inside thumbturn when it is being held in the locked position - where the XL13-439 option is specified in the hardware sets.
 - 9. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
 - a. (OPTION Vandlgard) Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
 - b. Lever Design: Schlage 03A.

2.07 EXIT DEVICES

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product:
 - a. Von Duprin 99 series
- 2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

- 1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
- 2. Cylinders: Refer to "KEYING" article, herein.
- 3. Provide grooved touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
- 4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
- 5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
- 6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
- 7. Provide flush end caps for exit devices.
- 8. Provide exit devices with manufacturer's approved strikes.
- 9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
- 10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
- 11. Verify exit device functions with owner prior to ordering.
- 12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
- 13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
- 14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.08 CYLINDER HOUSINGS

A. Manufacturers:

1. Scheduled Manufacturer and Product:
 - a. Schlage
2. Acceptable Manufacturers and Products:
 - a. Best

B. Requirements:

1. Provide cylinder housings from same manufacturer of locksets, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Provide cylinder housings in the below-listed configuration(s), distributed throughout the Project as indicated.
 - a. Cylinder/Core Type: Small Format Interchangeable Core (SFIC)
3. Replaceable Construction Cores.
 - a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - 1) 3 construction control keys
 - 2) 12 construction change (day) keys.
4. Verify with Owner where permanent cores are to be shipped to.

2.09 PERMANENT CORES, KEYING, KEYS

A. Manufacturers:

1. Scheduled Manufacturer: Best

B. Acceptable Manufacturers:

1. No Substitute

C. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

D. Permanent Core Requirements:

1. Provide permanent cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Provide cores in the below-listed configuration(s), distributed throughout the Project as indicated.
 - a. Match Owner's existing system.
 - b. Cylinder/Core Type: Small Format Interchangeable Core (SFIC).
 - c. Nickel silver bottom pins.

E. Keying Requirements:

1. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

2. Provide keying system capable of multiplex masterkeying.
3. Permanent cores keyed by the manufacturer according to the following key system.
 - a. Keying system as directed by the Owner.
 - b. Match Owner's existing system.
 - c. (Great)Grand Master Key System: Cylinders/cores operated by change (day) keys and subsequent masters (including grand/great grand) keys.
4. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
5. Provide keys with the following features:
 - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm).
6. Identification:
 - a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
 - b. Identification stamping provisions must be approved by the Architect and Owner.
 - c. Stamp keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE".
 - d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
7. Quantity: Furnish in the following quantities.
 - a. Change (Day) Keys: 3 per cylinder/core.
 - b. Permanent Control Keys: 3 (if required).
 - c. Master Keys: 6 per master.
 - d. Unused balance of key blanks shall be furnished to Owner with the cut keys.
8. Verify with owner where permanent cores and keys are to be shipped to.

2.10 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN 4040XP series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 5/8-inch (16 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.

6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.11 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Trimco
 - b. Rockwood

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with countersunk sheet metal screws, finished to match plates.
2. Height of protection plates as shown in the sets. Adjust height as required for bottom rail of door or to avoid conflicts with other hardware.
3. Width of plates as shown in the sets. Adjust width as required to avoid conflicts with other hardware.
4. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.12 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Trimco
 - b. Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.13 GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Zero International
2. Acceptable Manufacturers:
 - a. National Guard
 - b. Reese
 - c. Pemko

B. Requirements:

1. Provide gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

2.14 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Rockwood
 - b. Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.15 DOOR POSITION SWITCHES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Schlage
2. Acceptable Manufacturers:
 - a. George Risk Industries, Inc.

B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.16 FINISHES

- A. Provide finish for each item as indicated in the sets.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
 - 4. Installation Guide for Doors and Hardware: DHI TDH-007-20
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- H. Lock Cylinders:
 - 1. Install construction cores to secure building and areas during construction period.
 - 2. Replace construction cores with permanent cores as indicated in keying section.

- I. Wiring: Coordinate with Division 26 ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to panel interface modules, controllers, and gateways.
 - 4. Testing and labeling wires with Architect's opening number.
- J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- K. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- L. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
- M. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- N. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- O. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- P. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- Q. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 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.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.

- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets:

129011 OPT0415483 Version 1

HARDWARE GROUP NO. 01

For use on Door #(s):

A116B

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	DUMMY PUSH BAR X PULL TRIM	330 X 990DT	626	VON
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	MOUNTING PLATE	4040XP-18PA	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61	689	LCN
1	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE GROUP NO. 02

For use on Door #(s):

A112A A113A A114A

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW SIZE, QTY, NRP AS REQ'D (SEE SPECS)	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	L9040 03A L583-363 OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	KICK PLATE	8400 10"H X WIDTH AS REQ'D B-CS	630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	BLK	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 03

For use on Door #(s):

A119A A119B

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SIZE, QTY, NRP AS REQ'D (SEE SPECS)	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050BDC 03A L583-363	626	SCH
1	EA	PERMANENT CORE	MATCH EXISTING SYSTEM	626	BES
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 04

For use on Door #(s):

GATE

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	STOREROOM LOCK	L9080HD 03A	626	SCH
1	EA	PERMANENT CORE	MATCH EXISTING SYSTEM	626	BES

VERIFY EXACT LOCK TYPE REQUIRED. BALANCE OF HARDWARE BY DOOR MANUFACTURER.

HARDWARE GROUP NO. 05

For use on Door #(s):

A120A

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW SIZE, QTY, NRP AS REQ'D (SEE SPECS)	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	EU MORTISE LOCK	L9092BDCEU 03A 12/24 VDC	626	SCH
1	EA	PERMANENT CORE	MATCH EXISTING SYSTEM	626	BES
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	KICK PLATE	8400 10"H X WIDTH AS REQ'D B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	CREDENTIAL READER	BY ACCESS CONTROL INTEGRATOR		B/O
1	EA	POWER SUPPLY	BY ACCESS CONTROL INTEGRATOR		B/O

DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER WILL UNLOCK OUTSIDE LEVER, ALLOWING ACCESS. DOOR REMAINS LOCKED WITH LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 06

For use on Door #(s):

A104A

A109A

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	EU MORTISE LOCK	L9092BDCEU 03A 12/24 VDC	626	SCH
1	EA	PERMANENT CORE	MATCH EXISTING SYSTEM	626	BES
3	EA	SILENCER	SR64	GRY	IVE
1	EA	CREDENTIAL READER	BY ACCESS CONTROL INTEGRATOR		B/O
1	EA	POWER SUPPLY	BY ACCESS CONTROL INTEGRATOR		B/O

DOOR NORMALLY LOCKED. PRESENTING VALID CREDENTIAL TO READER WILL UNLOCK OUTSIDE LEVER, ALLOWING ACCESS. DOOR REMAINS LOCKED WITH LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 07

For use on Door #(s):

A106A A107A A108A

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 (NRP AS REQ'D)	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	EU MORTISE LOCK	L9092BDCEU 03A 12/24 VDC	626	SCH
1	EA	PERMANENT CORE	MATCH EXISTING SYSTEM	626	BES
3	EA	SILENCER	SR64	GRY	IVE
1	EA	CREDENTIAL READER	BY ACCESS CONTROL INTEGRATOR		B/O
1	EA	POWER SUPPLY	BY ACCESS CONTROL INTEGRATOR		B/O
1	EA	PUSH BUTTON RELEASE	BY INTERCOM SYSTEM		B/O

DOOR NORMALLY LOCKED. PRESENTING VALID CREDENTIAL TO READER, OR REMOTE PUSH BUTTON, WILL UNLOCK OUTSIDE LEVER, ALLOWING ACCESS. DOOR REMAINS LOCKED WITH LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 08

For use on Door #(s):

A109B A119C

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	EU MORTISE LOCK	L9092HDEU 03A 12/24 VDC	626	SCH
1	EA	SURFACE CLOSER (W/ SPRING STOP)	4040XP SCUSH	696	LCN
1	EA	MOUNTING PLATE	4040XP-18PA	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61	689	LCN
1	EA	WEATHERSTRIPPING	BY DOOR/FRAME MANUFACTURER		B/O
1	EA	DOOR SWEEP, BRUSH W/ DRIP	8198AA	AA	ZER
1	EA	THRESHOLD, 1/2"	655A	A	ZER
1	EA	CREDENTIAL READER	BY ACCESS CONTROL INTEGRATOR		B/O
1	EA	POWER SUPPLY	BY ACCESS CONTROL INTEGRATOR		B/O
1	EA	DOOR CONTACT	679 SERIES	BLK	SCE

DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER WILL UNLOCK OUTSIDE LEVER, ALLOWING ACCESS. DOOR REMAINS LOCKED WITH LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 09

For use on Door #(s):

A115A A118A

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SIZE, QTY, NRP AS REQ'D (SEE SPECS)	652	IVE
1	EA	STOREROOM LOCK	L9080BDC 03A	626	SCH
1	EA	PERMANENT CORE	MATCH EXISTING SYSTEM	626	BES
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	KICK PLATE	8400 10"H X WIDTH AS REQ'D B- CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 10

For use on Door #(s):

A116A

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
1	EA	PERMANENT CORE	MATCH EXISTING SYSTEM	626	BES
1	EA	RIM CYL HOUSING (SFIC)	80-159 (W/ KEYED CONST CORE)	626	SCH
1	EA	SURFACE CLOSER (W/ SPRING STOP)	4040XP SCUSH	696	LCN
1	EA	MOUNTING PLATE	4040XP-18PA	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61	689	LCN
1	EA	WEATHERSTRIPPING	BY DOOR/FRAME MANUFACTURER		B/O
1	EA	DOOR SWEEP, BRUSH W/ DRIP	8198AA	AA	ZER
1	EA	THRESHOLD, 1/2"	655A	A	ZER
1	EA	CREDENTIAL READER	BY ACCESS CONTROL INTEGRATOR		B/O
1	EA	POWER SUPPLY	BY ACCESS CONTROL INTEGRATOR		B/O
1	EA	DOOR CONTACT	679 SERIES	BLK	SCE

DOOR(S) NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER RETRACTS EXIT DEVICE LATCH ALLOWING ACCESS. EXIT DEVICE LATCH ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN (I.E. PUSH/PULL MODE) AS DESIGNATED BY ACCESS CONTROL SYSTEM SCHEDULE. EXIT DEVICE LATCHES AND LOCKS WITH LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 11

For use on Door #(s):
A101B

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	CONT. HINGE	112XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-99-DT	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
2	EA	PERMANENT CORE	MATCH EXISTING SYSTEM	626	BES
1	EA	MORTISE CYL HOUSING (SFIC)	80-110 (W/ DISP CONST CORE)	626	SCH
1	EA	RIM CYL HOUSING (SFIC)	80-159 (W/ KEYED CONST CORE)	626	SCH
2	EA	SURFACE CLOSER (W/ SPRING STOP)	4040XP SCUSH	696	LCN
2	EA	MOUNTING PLATE	4040XP-18PA	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30	689	LCN
2	EA	BLADE STOP SPACER	4040XP-61	689	LCN
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	EA	CREDENTIAL READER	BY ACCESS CONTROL INTEGRATOR		B/O
1	EA	POWER SUPPLY	BY ACCESS CONTROL INTEGRATOR		B/O
1	EA	PUSH BUTTON RELEASE	BY INTERCOM SYSTEM		B/O
2	EA	DOOR CONTACT	679 SERIES	BLK	SCE

DOOR(S) NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER, OR REMOTE PUSH BUTTON, RETRACTS EXIT DEVICE LATCH ALLOWING ACCESS. EXIT DEVICE LATCH ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN (I.E. PUSH/PULL MODE) AS DESIGNATED BY ACCESS CONTROL SYSTEM SCHEDULE. EXIT DEVICE LATCHES AND LOCKS WITH LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 12

For use on Door #(s):

A101A

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	CONT. HINGE	112XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-99-DT	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
2	EA	PERMANENT CORE	MATCH EXISTING SYSTEM	626	BES
1	EA	MORTISE CYL HOUSING (SFIC)	80-110 (W/ DISP CONST CORE)	626	SCH
1	EA	RIM CYL HOUSING (SFIC)	80-159 (W/ KEYED CONST CORE)	626	SCH
2	EA	SURFACE CLOSER (W/ SPRING STOP)	4040XP SCUSH	696	LCN
2	EA	MOUNTING PLATE	4040XP-18PA	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30	689	LCN
2	EA	BLADE STOP SPACER	4040XP-61	689	LCN
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	EA	WEATHERSTRIPPING	BY DOOR/FRAME MANUFACTURER		B/O
2	EA	DOOR SWEEP, BRUSH W/ DRIP	8198AA	AA	ZER
1	EA	THRESHOLD, 1/2"	655A	A	ZER
1	EA	CREDENTIAL READER	BY ACCESS CONTROL INTEGRATOR		B/O
1	EA	POWER SUPPLY	BY ACCESS CONTROL INTEGRATOR		B/O
1	EA	PUSH BUTTON RELEASE	BY INTERCOM SYSTEM		B/O
2	EA	DOOR CONTACT	679 SERIES	BLK	SCE

DOOR(S) NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER, OR REMOTE PUSH BUTTON, RETRACTS EXIT DEVICE LATCH ALLOWING ACCESS. EXIT DEVICE LATCH ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN (I.E. PUSH/PULL MODE) AS DESIGNATED BY ACCESS CONTROL SYSTEM SCHEDULE. EXIT DEVICE LATCHES AND LOCKS WITH LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 13

For use on Door #(s):

A121A

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PERMANENT CORE	MATCH EXISTING SYSTEM	626	BES

VERIFY EXACT CYLINDER TYPE REQUIRED. BALANCE OF HARDWARE BY DOOR MANUFACTURER.

END OF SECTION 08 71 00

SECTION 08 80 00 – GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Doors.
 - 2. Storefront framing.
 - 3. Interior borrowed lites.
 - 4. Glass shower door.
- B. Related Sections include the following:
 - 1. Division 08 Section "Aluminum-Framed Entrances and Storefront" for thermal performance requirements.

1.2 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters (mm) according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- D. Solar Heat Gain Coefficient (SHGC): The ratio of the solar heat gain through the glass relative to the incident solar radiation. Solar heat gain includes both direct and indirect gain. The direct gain is the solar energy directly transmitted through the glazing. The indirect gain is the solar energy absorbed by the glazing and subsequently convected and thermally radiated inward.
- E. Low-Emissivity ("Low-E"): Having the demonstrated ability to reduce heat gain or loss by reflecting long-wave infra-red (IR) energy (heat), thereby decreasing the U-value and improving energy efficiency.
 - 1. "Solar-Control" Low-E Glazing: Glazing that has a SHGC equal to or less than 0.40. Solar-control low-e coatings maximize the amount of daylight transmitted through the glass while minimizing both the amount of solar heat transmitted into the building and the amount of heat loss from the long-wave infrared portion of the heat spectrum.
- F. Sealed Insulating Glass Unit Surface Designations:
 - 1. Surface 1 – Exterior surface of the outer glass lite.
 - 2. Surface 2 – Interspace surface of the outer glass lite.
 - 3. Surface 3 – Interspace surface of the inner glass lite.
 - 4. Surface 4 – Interior surface of the inner glass lite.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances.

1.4 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each glass type and glazing material required, including installation and maintenance instructions.
 - a. Interior glass only required submittal.
 - b. Glass shower door and hardware components.

- c. Exterior glazing product data shall be included in the opening submittals, refer to other Division 08 Sections.
- d. **Do Not** provide exterior glazing product information under this Section.

- B. Glass Materials Samples:
 - 1. Spandrel glass color selections.

1.5 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 - 1. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Fabricator Qualifications for Insulating-Glass Units: Fabricator must be capable of producing certified sealed insulating-glass products equivalent to "CBA" level. Fabricators must be listed in the IGCC directory or submit evidence of quality-assurance program. The quality-assurance program, as a minimum, must have the following elements:
 - a. A quality manual.
 - b. Operating procedures documenting how insulating-glass units are fabricated.
 - c. A designated person responsible for quality assurance.
 - d. Routine product or component checks.
 - 2. Installer Qualifications: An experienced installer who has completed glazing similar in material design and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.
 - a. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass and Metal (AG&M) contractors.
 - 3. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC's CAP 1 Certification Agency Program.
 - 4. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.
- B. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of Insulating Glass Certification Council (IGCC).

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's and fabricators written instructions. Prevent damage to glass and glazing materials from:
 - 1. Condensation.
 - 2. Temperature changes.
 - 3. Direct exposure to sun.
 - 4. Other causes.
 - a. Primary seal protection: Follow manufacturer/fabricator protocols to minimize the risk for damage to, or failure of, the primary IG unit seal caused by shearing stresses during handling and storage.
 - b. Avoid glass-to-glass contact: Guard against latent damage to large IG units caused by glass-to-glass contact when subject to changes in temperature and/or barometric pressure.
 - 5. Protect from contact with corrosive chemicals.
 - 6. Avoid placement of glass edge on concrete, metal, or other hard objects.
- B. For insulating-glass units that might be exposed to substantial altitude changes, comply with insulating-glass fabricator's written recommendations for venting and sealing units to avoid hermetic seal ruptures.

- C. Deliver glass to site in suitable containers that will protect glass from the weather and from breakage. Carefully store material, as directed, in a safe place where breakage can be reduced to a minimum. Deliver sufficient glass to allow for normal breakage. Glazing compounds shall arrive at the project site in labeled containers that have not been opened.
 - 1. Exercise exceptional care to prevent edge damage to glass, and damage/deterioration to coating on glass.

1.8 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 liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

- A. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
- B. Laminated Glass: Fabricator's standard form in which laminated-glass fabricator 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 attributable to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions.
 - 1. Defects include:
 - a. Edge separation.
 - b. Delamination materially obstructing vision through glass.
 - c. Blemishes exceeding those allowed by referenced laminated-glass standard.
 - 2. Warranty Period: Ten years from date of Fabrication.
- C. Insulating Glass: Fabricator's standard form in which insulating-glass fabricator 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 attributable to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions.
 - 1. Evidence of failure is the obstruction of vision by:
 - a. Dust.
 - b. Moisture.
 - c. Film on interior surfaces of glass.
 - 2. Glass breakage due to thermal stress will be replaced by the Contractor at no additional cost to the Owner during the guarantee period.
 - 3. Warranty Period: Manufacturer's/fabricators standard but not less than 10 years after date of Fabrication.
- D. Ceramic Frit and Silkscreened Glass: Provide a written 5-year warranty from date of fabrication for ceramic frit and silkscreened glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers of Non-Fire-Protection-Rated Glass: Subject to compliance with requirements, provide products from the following.
 - 1. AGC Primary Division and AGC Coatings Division, AGC Flat Glass North America, Inc. (fka AFG), Asahi Glass America, Inc., Asahi Glass Co. Ltd.
 - 2. Cardinal IG Co., Cardinal Glass Industries.

3. Guardian/Sunguard Industries Corp.
 4. Pilkington North America Inc. (fka LOF), Nippon Sheet Glass (NSG) Co. Ltd.
 5. Vitro Glass (fka PPG Flat Glass).
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least ten days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
1. Obtain tinted glass from single sourced from single manufacturer.

2.2 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 the following:
1. Defective manufacture, fabrication, or installation.
 2. Failure of sealants or gaskets to remain watertight and airtight.
 3. Deterioration of glazing materials.
 4. Other defects in construction.
- B. Delegated Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat-treated) required to meet or exceed the following criteria:
1. Glass Thicknesses: Select minimum glass thickness to comply with ASTM E 1300, according to the following requirements:
 - a. Design Wind Loads: Determine design wind loads applicable to the Project according to ASCE 7, Minimum Design Loads for Buildings and Other Structures: Section 6.5, Method 2 – Analytical Procedure, based on mean roof heights above grade indicated on drawings.
 - 1) Refer to Structural Drawings for loading information.
 2. Design Snow Loads: As indicated on Drawings, but not less than snow loads applicable to Project as required by ASCE 7, "Minimum Design Loads for Buildings and other Structures"; Section 7.0, "Snow Loads".
 3. Probability of Breakage for Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load. Minimum thickness of annealed or heat-treated glass products to be selected so the worst case probability of failure does not exceed 8 breaks per 1,000 for glass under wind action.
 4. Probability of Breakage for Sloped Glazing: For glass surfaces 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 3/4 inch, whichever is less.
 6. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
1. Change in Ambient Temperature: 120 degrees Fahrenheit
 2. Change in Temperature of Material Surfaces: 180 degrees Fahrenheit

D. Regulatory Requirements:

1. Safety Glazing: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
 - a. Subject to compliance with requirements, permanently mark safety glazing with certification label of Safety Glazing Certification Council (SGCC) or another certification agency acceptable to authorities having jurisdiction.
 - 1) Identification on tempered glass shall include the words "Tempered Safety Glass".
 - b. Where glazing units, including Kind-FT (fully tempered) glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 square feet in exposed surface area of one side, provide glazing products that comply with Category II materials. For lites 9 square feet or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials.
 - 1) Exception for hazardous locations: Where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified and required by Opening Manufacturer to meet requirements, 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 6mm 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, according to NFRC 100 and based on LBNL's WINDOW 6.3 computer program, expressed as Btu/sq.ft. x h x deg F.
5. Solar Height-Gain Coefficient and Visible Transmittance: Center of glazing values, according to NFRC 200 methodology and based on LBNL's Window 6.3 computer program.
 - a. Solar Heat Gain Coefficient: Shall not be greater than the following:
 - 1) 0.40
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 FABRICATORS

- A. Fabricators of Non-Fire-Protection-Rated Glass: Subject to compliance with requirements, provide products by one of the fabricators listed as certified with IGCC or meeting "Quality Assurance" requirements.

2.4 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass manufacturers, glass product fabricators, and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. Glass Association of North America (GANA):
 - a. Glazing Manual (2009).
 - b. Sealant Manual (2008).
 2. Laminating Division of GANA: Laminated Glass Design Guide (2000).
 3. American Architectural Manufacturers Association (AAMA):
 - a. Glass Design for Sloped Glazing (AAMA GDSG-1-87).
 4. Insulating Glass Manufacturers Alliance (IGMA):
 - a. SIGMA TM-3000 "Glazing Guidelines for Sealed Insulating Glass Units".
 - b. IGMA Guidelines for Sloped Glazing (IGMA TB-3001-01).
- 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 or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IgCC.

- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
- E. Strength: Where float glass is indicated, provide annealed float glass, Kind-HS heat-treated float glass, or Kind-FT heat-treated float glass as needed to comply with Performance Requirements article. Where heat-strengthened glass is indicated, provide Kind-HS heat-treated float glass or Kind-FT heat-treated float glass as needed to comply with Performance Requirements article. Where fully tempered glass is indicated, provide Kind-FT heat-treated float glass.
 - 1. Insulated Glass
 - a. Unless glass is noted as tempered all clear insulated glass greater than 35 sq.ft. shall be heat-strengthened.

2.5 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality q3 (glazing select), Class 1 (clear).
- B. Heat-Strengthened Float Glass: ASTM C 1048, Type I (transparent flat glass), Quality q3 (glazing select), of class, kind, and condition indicated.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated. Performance requirements:
 - a. Distortion Tolerance: Roll wave peak-to-valley (PV) not to exceed 0.003 center/0.008 edges.
 - b. Millidiameter: 90 percent of surface not to exceed +/- 120 millidiameters.
 - c. Monitoring: Every lite measured with an on-line distortion measurement system.
 - d. Bow/Warp Tolerance: Maximum tolerance for bow/warp is 1/2 of ASTM C 1048.
 - e. All documentation recorded and may be available upon request.
 - 2. Provide Kind-HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
 - a. Minimum requirements
 - 1) All clear insulated glass greater than 35 sq.ft. shall be heat-strengthened or tempered.
 - 3. For uncoated glass, comply with requirements for Condition A.
 - 4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
 - 5. Provide Kind-FT (fully tempered) float glass in place of annealed or Kind-HS (heat-strengthened) float glass where safety glass is indicated.
- 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. Performance requirements:
 - a. Distortion Tolerance: Roll wave peak-to-valley (PV) not to exceed 0.003 center/0.008 edges.
 - b. Millidiameter: 90 percent of surface not to exceed +/- 120 millidiameters.
 - c. Monitoring: Every lite measured with an on-line distortion measurement system.
 - d. Bow/Warp Tolerance: Maximum tolerance for bow/warp is 1/2 of ASTM C 1048.
 - e. All documentation recorded and may be available upon request.
- D. Tinted Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality q3 (glazing select), Class 2 (tinted heat-absorbing and light-reducing).
- E. Wired Glass: Not acceptable.

- F. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum-deposition process after manufacture and heat-treatment (if any), and complying with other requirements specified.
 - 1. Kind: Kind CV (coated vision glass).
 - a. Exception where the lower edge of the glass is more than 6 feet above the adjacent floor level or cannot be approached closer than 10 feet: Kind CO (coated overhead glass).
- G. Silicone-Coated Spandrel Glass: ASTM C 1048, Condition C (other uncoated glass), Type I (transparent flat glass), Quality q3 and complying with other requirements specified.

2.6 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172 and complying with testing requirements in 16 CFR 1201 for Category II materials and with other requirements specified. Use materials that have a proven track record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation. Use same interlayer material throughout project.
 - 1. Construction: Laminate glass with polyvinyl-butylal interlayer to comply with interlayer manufacturer's written recommendations.
 - a. Do not use a cast-in-place and cured-transparent-resin interlayer.
 - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.
 - 4. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.
 - a. Laminate lites in autoclave with heat plus pressure.

2.7 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 - 1. Provide Kind-HS (heat-strengthened or fully tempered) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
 - a. All clear insulated glass greater than 35 sq.ft. shall be heat-strengthened or tempered.
 - 2. Provide Kind-FT (fully tempered) glass lites where safety glass is indicated.
 - 3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
- B. Sealing System: Dual-seal, with manufacturer's standard primary and secondary.
- C. Spacer: Manufacturer's recommended spacer material and construction, required to meet thermal performance requirements of opening.
- D. Desiccant: Molecular sieve or silica gel, or blend of both.

2.8 GLASS USAGE

- A. General: Hereinafter are the minimum glazing requirements. Adjust sealed space, spacer, and coating as required to meet opening performance requirements. Glass shall be as required by opening manufacturer to meet thermal requirements as documented in manufacturer's published test data or verified with testing prescribed.

B. Exterior:

1. Basis of Design: Select glazing type in combination with opening assembly performance requirements outlined in other Division 08 Sections.
 - a. Minimum performance requirements shall equal or exceed Vitro, Solarban 60. Utilize other glass products as required to comply with opening assembly performance requirements specified.
 - 1) Thermal Transmittance: U-factor not more than 0.29 Btu/sq.ft. x h x deg F.
 - 2) Solar Heat Gain Coefficient: No greater than 0.39.
2. Glass for Exterior Doors:
 - a. 25-mm thick fully tempered insulating glass consisting of 6.0-mm thick, minimum, grey tint outer panel, a 13-mm wide hermetically sealed air or gas as required to meet opening "Performance Requirements". space, and 6.0-mm thick, minimum, clear inner panel and shall be factory-installed.
 - 1) Provide low-e coating on second or third surface as required to meet opening "Performance Requirements".
3. Storefront: 25-mm thick insulating glass consisting of 6.0-mm thick, minimum, grey tint, outer panel, a 13-mm wide hermetically sealed air or argon space, as required to meet opening "Performance Requirements" and 6.0-mm thick clear glass inner panel.
 - a. Provide heat-strengthened glass when lite is tinted and tempered glass where indicated or required by "Performance Requirements" and "Regulatory Requirements" and glass manufacturer.
 - b. Provide solar-control low-e coating on second or third surface as required to meet opening "Performance Requirements".
4. Glass for Storefront and Doors (Insulated Security Glazing):
 - a. 25-mm thick insulating glass consisting of 6.0-mm thick, minimum, grey tint outer panel, a 11-mm wide hermetically sealed air or argon space, as required to meet opening "Performance Requirements" and 8.0-mm thick clear laminated glass inner panel.
 - 1) Provide heat-strengthened glass when lite is tinted and tempered glass where indicated or required by "Performance Requirements" and "Regulatory Requirements" and glass manufacturer.
 - 2) Provide solar-control low-e coating on second or third surface as required to meet opening "Performance Requirements".
 - 3) Laminate glass, type LT consisting of two lites of 1/8 inch thick heat strengthened glass with 0.090 clear plastic interlayer. Within insulated unit adjust thickness of air space as required to install into Aluminum Door, Aluminum Storefront or Aluminum Curtain Wall systems. Minimum thickness shall be 1 inch, 25mm.
5. Ceramic-Coated or Silicone Spandrel Insulating Glass:
 - a. Construction: Provide units that comply with requirements specified for insulating-glass units except for indoor lite.
 - 1) Kind FT (fully tempered).
 - 2) Ceramic Coating Location: Fourth surface.
 - a) Color: As selected by A/E from manufacturer's full range. Color shall compliment glass tint.

C. Interior:

1. Glass for Vestibule Doors, Sidelights, and Transoms: 6-mm thick clear tempered safety glass, unless otherwise noted.
2. Glass for Interior Non-Fire-Protection-Rated Doors, Storefront, and Windows: 6-mm thick clear tempered glass.

2.9 GLASS SHOWER DOOR

A. Frameless Glass Shower Door: Hinged, single door

1. Clear tempered glass in compliance with ANSI Z97.1 and 16 CFR 1201.
 - a. 3/8 inch thick.
 - b. Coating: Coating similar to Guardian Glass "Shower Guard" coating to protect build-up of soap scum and hard water deposits.

2. Hardware: Polished anodized aluminum and heavy duty vinyl.
 - a. Deflector and sweep channel for door bottom.
 - b. "L" Vinyl gasket for jambs.
 - c. Manufacturer's standard heavy duty wall mount hinges, 2 minimum, for out-swinging door.
 - d. Manufacturer's standard 6 inch, double sided "C-Pull Handle".
3. Manufacturer: Century Bathworks or similar.

2.10 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
 1. EPDM, ASTM C 864.
 2. Silicone, ASTM C 1115.
 3. Thermoplastic polyolefin rubber, ASTM C 1115.
- B. Soft Compression Gaskets:
 1. Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below, complying with ASTM C 509, Type II, black, and of profile and hardness required to maintain watertight seal:
 - a. EPDM.
 - b. Silicone.
 - c. Thermoplastic polyolefin rubber.
 2. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.11 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
 1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Colors of Exposed Glazing Sealants: As selected by A/E from manufacturer's full range.
 4. Glazing materials brought on site shall contain less than one percent asbestos by content.
- B. Elastomeric Glazing Sealant Standard (Weatherseal): Comply with ASTM C 920 and other requirements indicated for each liquid-applied, chemically curing sealant, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
 1. Low-Modulus Neutral-Curing Silicone Glazing Sealant (ASTM C 920, Type S, Grade NS, Class 100/50, Use NT):
 - a. 790 by Dow Corning Corp.
 - b. Bondaflex Sil 290 by May National Associates, Inc.; a subsidiary of Sika Corporation.
 - c. Silpruf LM SCS2700 by Momentive Performance Materials Inc., Apollo Management, LP (fka GE Sealants and Adhesives).
 - d. 890 by Pecora Corp.
 - e. PSI-641 by Polymeric Systems, Inc., Whitford Worldwide.
 - f. Spectrem 1 by Tremco Sealant/Weatherproofing Division, RPM International Inc.
 2. Medium-Modulus Neutral-Curing Silicone Glazing Sealant (ASTM C 920, Type S, Grade NS, Class 50, Use NT):

- a. Omniseal 50 by BASF Building Systems (fka DeGussa, fka ChemRex, fka Sonneborn), BASF Construction Chemicals Americas, BASF Aktiengesellschaft.
 - b. 756-SMS, 791, 795, or 995 by Dow Corning Corp.
 - c. Bondaflex Sil 295 by May National Associates, Inc.
 - d. SilGlaze II SCS2800, Silpruf NB SCS9000, Silpruf SCS2000, or UltraPruf II SCS2900 by Momentive Performance Materials Inc., Apollo Management, LP (fka GE Sealants and Adhesives).
 - e. 864, 895, 895NST, or 898 by Pecora Corp.
 - f. PSI-641 by Polymeric Systems, Inc., Whitford Worldwide.
 - g. SikaSil-C995 by Sika Corp. (USA).
 - h. Spectrem 2 or Spectrem 3 by Tremco Sealant/Weatherproofing Division, RPM International Inc.
3. High-Modulus Neutral-Curing Silicone Glazing Sealant (ASTM C 920, Type S, Grade NS, Class 25, Use NT):
- a. 799 by Dow Corning Corp.
 - b. Bondaflex Sil 200 GPN and Bondaflex Sil 201 FC by May National Associates, Inc.
 - c. UltraGlaze SSG4000 or UltraGlaze SSG4000AC by Momentive Performance Materials Inc., Apollo Management, LP (fka GE Sealants and Adhesives).
 - d. PSI-631 by Polymeric Systems, Inc., Whitford Worldwide.
 - e. PolyGlaze Plus (SM5731) by Schnee-Moorehead (S-M) Division, Illinois Tool Works (ITW) Inc.
 - f. Proglaze SSG or Tremsil 600 by Tremco Sealant/Weatherproofing Division, RPM International Inc.
4. High-Modulus Acid-Curing Silicone Glazing Sealant (ASCTM C 920, Type S, Grade NS, Class 25, Use NT):
- a. OmniPlus by BASF Building Systems (fka DeGussa, fka ChemRex, fka Sonneborn), BASF Construction Chemicals Americas, BASF Aktiengesellschaft.
 - b. Chem-Calk 1200 by Bostik Construction Products Division, Bostik Findley Unit of TotalFinaElf.
 - c. 999-A by Dow Corning Corp.
 - d. Sil 100 GC, Sil 100 GP, or Sil 100 WF by May National Associates, Inc.
 - e. Contractors SCS1000 or SCS1200 by Momentive Performance Materials Inc., Apollo Management, LP (fka GE Sealants and Adhesives).
 - f. 860 by Pecora Corp.
 - g. PSI-601 by Polymeric Systems, Inc., Whitford Worldwide.
 - h. PolyGlaze (SM5732) by Schnee-Moorehead (S-M) Division, Illinois Tool Works (ITW) Inc.
 - i. Proglaze or Tremsil 200 by Tremco Sealant/Weatherproofing Division, RPM International Inc.

2.12 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent, non-staining and non-migrating in contact with non-porous surfaces, with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated, packaged on rolls with a release paper backing, and complying with ASTM C 1281 and AAMA 800 for products indicated below:
- 1. AAMA 804.3 tape, where indicated.
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, polyvinyl-chloride (PVC) foam tapes, factory-coated with adhesive on both surfaces, and complying with AAMA 800 for the following types:
- 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.13 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus-or-minus 5.
 - 1. Type recommended by sealant or glass manufacturer.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
 - 1. Type recommended by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise optimum glazing sealant performance.

2.14 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, 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.
- D. Heat-Strengthened/Tempered Glass: Cut float glass materials to indicated sizes and provide cut-outs and holes, if indicated, before heat strengthening.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine glass framing, 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 system.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION FOR GLAZING

- A. Clean the glazing channel or other framing members to receive glass, immediately before glazing. Remove coatings that are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.
 - 1. Seal porous glazing channels and recesses with primer or sealer compatible with substrate.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.
- B. 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.
 - 1. All glazing exposed to exterior shall be wet/wet or wet/dry in accordance with GANA Glazing Manual for window type.
- C. Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors) without failure, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and air tight, deterioration of glazing materials, and other defects in the Work.
- D. Adjust glazing channel dimensions as required by project conditions during installation to provide:
 - 1. Necessary bite on glass.
 - 2. Minimum edge and face clearances.
 - 3. Adequate sealant thicknesses, with reasonable tolerances.
- E. The glazier is responsible for correct glass size for each opening within the tolerances and necessary dimensions established.
- F. Protect glass from edge damage at all times during handling, installation, and operation of the building. 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.
 - 1. Inspect each piece of glass immediately before installation and eliminate those that have observable edge damage or face imperfections.
- G. Apply primers or sealers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant substrate testing and as recommended by sealant manufacturer.
- H. 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.
- I. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- J. Provide spacers inside and out and of proper size and spacing for glass lites where length plus width is larger than 50 united inches, except where gaskets are used for glazing.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width.
 - a. Exception for Glazing Tape: Use thickness slightly less than final compressed thickness of tape.
 - K. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
 1. Coordinate glazing with wood door stops so stop is flush with outside of face veneer.
 - L. Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in the channel at the heel of jambs and head (do not leave voids in the sill channels) except as otherwise indicated, depending on light size, thickness and type of glass, and complying with manufacturer's recommendations.
 - M. Do not attempt to cut, seam, nip, or abrade glass that is tempered, heat-strengthened, or coated.
 - N. Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
 - O. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
 - P. Set glass lites with proper orientation so that coatings face fire side or protected of exterior or interior as specified.
 - Q. Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of the channel, so as to eliminate dirt and moisture pockets.
 - R. Clean and trim excess glazing materials from the glass and stops or frames promptly after installation and eliminate stains and discoloration.
 - S. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on the opposite side, provide adequate anchorage to ensure that gasket does not "walk" out when subjected to dynamic movement.
 - T. Square-cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away. Seal corner joints and butt joints with sealant recommended by gasket manufacturer.
- 3.4 TAPE GLAZING
- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
 - B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
 - C. Cover vertical framing joints by applying tape to heads and sills first and then to jambs. Cover horizontal framing joints by applying tape to jambs and then to heads and sills.
 - D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
 - E. Do not remove release paper from tape until just before each glazing unit is installed.
 - F. Apply heel bead of elastomeric sealant.

- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joint miter cut and bonded together at corners.
- C. Installation with Drive-In Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.8 CURING

- A. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength, and surface durability.

3.9 PROTECTION, AND CLEANING

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect exterior glass from breakage and other damage immediately upon installation by attaching crossed streamers to framing held away from glass. Do not apply markers to surfaces of glass. Remove non-permanent labels and clean surfaces.

- C. Protect glass from contact with contaminating substances resulting from construction operations. If despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- D. Examine glass surfaces adjacent to or below exterior concrete and masonry surfaces at frequent intervals during construction – but not less than once a month – for buildup of dirt, scum, alkaline deposits, or stains. Remove as recommended in writing by glass manufacturer.
- E. Remove and replace glass that is broken, chipped, cracked, or abraded, or that is otherwise damaged due to natural causes, accidents, or vandalism, during the construction period.
- F. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass according to:
 - 1. Written recommendations of glass manufacturer.
- G. Do not use scrapers or other metal tools to clean glass.

END OF SECTION 08 80 00

DIVISION

9

FINISHES

SECTION 09 01 91 - MOISTURE RESISTANT/WATER-PROOF FLOORING ADHESIVE FOR CONCRETE SLABS

PART 1 - GENERAL

1.1 SUMMARY

- A. Water-proof adhesives for interior concrete slabs scheduled for floor finish of resilient tile flooring, rubber flooring, resilient sheet flooring, and other approved flooring materials.
- B. Related Sections
 - 1. Division 03 Section "Cast-In Place Concrete": Installation and curing requirements according to ACI 302.

1.2 REFERENCES

- A. American Society of Testing and Materials (ASTM):
 - 1. C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
 - 2. C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
 - 3. F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
 - 4. F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- B. International Concrete Repair Institute (ICRI) Guideline No. 310.2-1997 (formerly 03732): Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

1.3 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Warranty: Warranty documents specified herein.

1.4 QUALITY ASSURANCE

- A. The Waterproof Adhesive shall be specifically formulated and marketed for water vapor resistance and alkalinity control. System design shall provide warranted adhesive bond suitable to 95.0% in situ relative humidity per ASTM F2170 or to the maximum of allowed testing equipment.
- B. Installer Qualifications: Applicator shall be approved by the manufacturer, experienced in surface preparation and application of the material and shall be subject to inspection and control by the manufacturer.
- C. Mock-up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Do not proceed with remaining work until workmanship, color, and sheen are approved by A/E.
 - 2. Refinish mock-up area as required to produce acceptable work.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to the job site in their original unopened containers, clearly labeled with the manufacturer's name and brand designation.
- B. Store products in an approved ventilated dry area; protect from dampness, freezing, and direct sun light. Product should not be stored in areas with temperatures in excess of 90 degrees F or below 50 degrees F.

- C. Handle product in a manner that will prevent breakage of containers and damage products.

1.6 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not apply Waterproof Adhesive to surfaces when water is accumulated on the surface of the concrete.
- C. Do not apply moisture resistant or water-proof adhesives when temperature is lower than 50 degrees F or expected to fall below this temperature within 24 hours from time of application.
- D. Allow continuous ventilation and indirect air movement at all times during application and curing process of the moisture resistant or water-proof adhesive.

1.7 SCHEDULING

- A. Before installation of VCT, sheet vinyl, rubber flooring, or other over the interior concrete slabs, in situ relative humidity testing shall be performed per ASTM F2170 to determine the level of relative humidity in the slab.
- B. Coordinate the scheduling of the Waterproof Installation System Mock- up, allowing adequate time to apply and review results.

1.8 WARRANTY

- A. Manufacturer shall provide a system warranty including adhesives and surface preparation products for a period of no less than ten (10) years at no additional cost.
- B. Installer of moisture resistant or water-proof adhesives shall provide standard installation warranty for workmanship.

PART 2 - PRODUCTS

2.1 SYSTEM

- A. Moisture resistant or water-proof flooring adhesive having the performance profile to withstand elevated alkaline moisture identified per ASTM F2170.
- B. Product: Suitable for application to prepared concrete exhibiting in situ relative humidity reading OF 95%RH.
- C. Basis-of-Design Product: Formulators' Aquaflex Waterproof Installation System comparable system recommend by flooring manufacturer for full system warranty or one of the following.
 - 1. Flexera (HT) Premium Universal Adhesive: TEC.
 - 2. TrowelFast Vinyl Flooring Adhesive: TEC.
 - 3. 5092 HT: Parabond.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared per ASTM F710.
- B. If substrate preparation is the responsibility of another installer, notify A/E of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Inspect surfaces with manufacturer's representative to determine its suitability to receive the moisture resistant or water-proof flooring adhesive. Provide an uncontaminated, sound surface.
- B. Clean surfaces to receive moisture resistant or water-proof flooring adhesive. Remove defective materials, and foreign matter such as dust, adhesives, leveling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, etc. Mechanically prepare concrete to ASTM F710 standards.
- C. Repair cracks, expansion joint, control Joints, and open surface honeycombs by filling with epoxy-based crack repair material.
- D. Use Patch Mix to repair surface defects with requirements listed in manufacturer's technical data information. No exceptions. Consult with manufacturer.
- E. Do not acid etch surface.
- F. Verify that the substrate surface does not deteriorate due to the presence of sulphurous compounds, fly ash or alkaline aggregate/silica reaction encountered in certain areas.
- G. Consult with system manufacturer prior to application.
- H. The surface substrate shall remain uncontaminated, absorptive, smooth and sound prior to receiving moisture resistant or water-proof flooring adhesive per ASTM F-710. Comply with all requirements as listed in manufacturer's technical data information. No exceptions.

3.3 APPLICATION

- A. Adhesive Application:
 - 1. The coverage rates for the moisture resistant or water-proof flooring adhesive are dependent on the surface texture and porosity of the substrate.
- B. Product selection and required application rate relative to existing levels of moisture per ASTM F2170.

3.4 TESTING

- A. Initial Tests:
 - 1. ASTM F2170, insitu relative humidity testing shall be performed by the installer.
 - 2. Provide initial results of ASTM F2170 to A/E. Tests shall be performed on properly prepared concrete.
 - 3. Conduct ASTM F2170 tests at the same temperature and humidity as designed normal occupancy. If this is not possible, test conditions shall be 75 degrees F +/-10 degrees (24 degree C +/- 5 degrees) and 50 percent +/-10 percent relative humidity. Maintain these conditions 48 hours prior to and during tests.
 - 4. Installer shall provide test results with a marked up floor finish plan showing test placement.
- B. Post-Treatment / Pre-Flooring Tests:
 - 1. Before installation of VCT, sheet vinyl, rubber flooring, and/or other flooring, and after mechanical preparation of concrete surface, conduct a porosity test. This test will involve placing a single droplet of water on the concrete surface and spreading to the size of a quarter dollar. Water should absorb within 30 seconds.
 - 2. The installer shall provide test results of the level of in situ relative humidity (%RH) and absorption test of the concrete slab to all parties involved. The flooring manufacturer and installer shall accept the floor condition and certify that the flooring application materials and methods are compatible with the test results and floor condition.

C. Adhesion

1. The flooring installer shall verify the usage of cementitious materials prior to the installation of any concrete repair materials.
2. The flooring installer will consult manufacturers 72 hours prior to adhesive application concerning installation strategy and technique.

3.5 CLEANING

- A. Remove all debris resulting from installation from project site.

3.6 PROTECTION

- A. Protect applied adhesive during specified cure period from any kind of traffic, topical water and contaminants.

END OF SECTION 09 01 91

SECTION 09 21 16.00 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Gypsum board, metal accessories, fasteners, and related items necessary as indicated and as follows:
 - 1. Interior gypsum board products types, sizes, and thickness indicated.
 - a. Gypsum boards shall have fire-resistance ratings and be moisture and mold resistant.
 - 1) Joint treatment shall be moisture and mold resistant.
 - 2. Tile backing boards shall be glass-mat, water-resistant backing board, unless otherwise indicated.
 - a. Tile backing boards, located in shower rooms and "wet" walls shall be cementitious backer board.
 - 3. Acoustical insulation unless specifically excluded.
 - 4. Reinforcement, both metal and wood, within framing systems to support wall and ceiling-mounted furnishings or equipment provided by other trades.
- B. Related Sections include the following:
 - 1. Division 06 Section "Rough Carpentry": For wood framing and blocking.
 - 2. Division 06 Section "Sheathing": For gypsum sheathing (exterior).
 - 3. Division 07 Section "Thermal Insulation": For thermal insulation and vapor barriers.
 - 4. Division 09 Section "Interior Painting": For primers applied to gypsum board surfaces and for coordination of repair work.

1.2 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C11 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.
- B. Wet Walls: Walls with plumbing fixtures mounted on them and walls in restrooms, locker rooms, showers or similar areas that will be intermittent wet.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination
 - 1. Coordinate blocking and furring work with installers of related work including, but not limited to casework, acoustical ceilings, thermal insulation, gypsum board, light fixtures, mechanical system, electrical systems, and sprinklers.
 - 2. All work above ceiling line should be completed, prior to installing the gypsum board. There should be no materials resting against or wrapped around the suspension system, hanger wires or ties.
- B. Pre-Installation Meeting: Conduct a pre-installation meeting to verify project requirements, substrate conditions, and manufacturer's installation instruction.
 - 1. Review blocking requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's product data and installation instructions for each type of product indicated, including other data as might be required to show compliance with these Specifications, manufacturer's printed installation instructions.
 - 1. Submit data indicating compliance with "fire-test-response characteristics".

1.5 QUALITY ASSURANCE

- A. Materials or operations specified by reference to the published specifications of a manufacturer or other published standards shall comply with the requirements of the standards listed.
 - 1. Standards include ASTM C840 and GA216, except more stringent requirements of manufacturer shall govern.
 - 2. Materials brought on-site shall contain less than 1 percent asbestos by polarized light microscopy (PLM) analysis.
 - 3. Apply acoustical sealant in accordance with applicable requirements of ASTM C919.
- B. Refer to "Recommended Specification on Levels of Gypsum Board Finish" as published by the Gypsum Association (and AWCI/CISCA/PDCA) for finish levels required herein.
- C. Mold-Resistant: Gypsum board assemblies designed to provide extra protection against mold and mildew compared to standard paper-faced wallboard products. When tested by an independent lab per ASTM D3273 ("Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber") gypsum board shall achieve an average board score of 8 or greater out of a possible high score of 10.
- D. Gypsum Board Finish Mockups: Before finishing gypsum board assemblies, install mockups of at least 100 sq.ft. in surface area to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Install mockups for the following applications:
 - a. Level 4 and level 5 finish.
 - 2. Simulate finished lighting conditions for review of mockups.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected from weather, condensation, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum boards flat to prevent sagging.
 - 1. Protect joint compounds from freezing.
- C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.7 FIELD CONDITIONS

- A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C840 and with gypsum board manufacturer's recommendations. Do not install gypsum board when ambient temperature is below 40 deg. F.
 - 1. Do not install paper-faced gypsum boards until installation areas are enclosed and conditioned.
 - a. Only interior extended exposure gypsum boards maybe installed.
 - 2. Maintain dry bulb temperatures between 55 and 80 degrees F. and relative humidity at less than 50 percent during taping and curing of joint compound.
- B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 degrees F. For adhesive attachment and finishing of gypsum board, maintain not less than 55 degrees F. for 48 hours prior to application and continuously after until dry. Do not exceed 80 degrees F. when using temporary heat sources.
- C. Ventilation: Ventilate building spaces, as required, for dry joint-treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Moisture and Mold Resistant Gypsum Boards
 - a. EcoSmart Mold Tough (Firecode); United States Gypsum Company
 - b. XP Fireshield Wallboard; National Gypsum Co.
 - c. M2Tech Gypsum Wallboard or Air Renew (Type X); CertainTeed Gypsum, Inc.
 - d. M-Bloc (Type X) ; American Gypsum
 - e. Mold-Guard Gypsum Board, ToughRock Mold-Guard, or Dens Armour Plus (Interior) (Type X); Georgia Pacific
 - f. Mold Defense (Type X); Continental Building Products, LLC (fka Lafarge)
 - 2. Glass-Mat, Water-Resistant Tile Backing Board
 - a. GlasRoc Tile Backer Type X; CertainTeed Corp.
 - b. Gold Bond eXP Tile Backer; National Gypsum Company
 - c. Durock Brand Glass-Mat Tile Backerboard; USG Corporation
 - d. DensShield Tile Backer; Georgia-Pacific Gypsum LLC
 - 3. Cementitious Tile Backer Units
 - a. Wonderboard; Custom Building Products
 - b. Util-A-Crete Concrete Backer Board; Fin Pan, Inc.
 - c. Durock Cement Board; USG Corp.
 - d. Perma Base Cement Board; National Gypsum Co.
 - e. Hardiebacker 500; James Hardie Building Products, Inc.
 - f. C-Cure Board 900; C-Cure.
 - g. CertainTeed LLC; Saint-Gobain North America.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other board products or from a manufacturer acceptable to the gypsum board manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. System Requirements: Fabricate and install systems as indicated, but not less than that required to comply with ASTM C754 under the following conditions:
 - 1. Gypsum board partitions:
 - a. Standard systems: Maximum deflection of L/240 of partition height.
 - b. Systems to receive tile: Maximum deflection of L/360 of partition height.
 - 2. Interior Suspended Ceilings and Soffits: Maximum deflection of L/360 of distance between supports.
 - 3. Design framing system to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of 1 inch, unless otherwise noted.

- B. Fire-Resistance-Rated Assemblies: Where fire-resistance-rated gypsum board assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction or other methods acceptable to authorities with jurisdiction.
 - 1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory" or GA-600, "Fire Resistance Design Manual" where accepted by local authorities.
- C. STC-Rated Assemblies: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by a qualified independent testing agency.
 - 1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."
 - 2. Plenum Rating: Provide glass or slag-wool-fiber/rock-wool-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
 - a. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm air velocity.
 - b. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

2.3 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A641, Class 1 zinc coating, soft temper or of a material and size having superior corrosion-resistance and equivalent strength to the galvanized steel wire specified.
 - 1. Tie wire shall be 0.0625-inch or double strand of 0.0475 inch diameter wire.
- B. Hangers: As follows:
 - 1. Wire Hangers: ASTM A641, Class 1 zinc coating, soft temper, 0.162 inch diameter.
 - 2. Rod Hangers: ASTM A510, mild carbon steel.
 - a. Diameter: 1/4 inch, unless otherwise indicated or required by load.
 - b. Protective Coating: ASTM A 153, hot-dip galvanized or rust-inhibitive paint.
 - 3. Flat Hangers: Commercial-steel sheet, ASTM A653, G40, hot-dip galvanized, unless otherwise noted.
 - a. Size: 1 by 3/16 inch by length indicated, unless otherwise noted or required by loads.
 - 4. Angle Hangers: ASTM A 653, G60, hot-dip galvanized commercial-steel sheet.
 - a. Minimum Base Steel Thickness: 0.296, unless otherwise noted.
 - b. Size: 1-5/8 by 1-5/8 inches.
- C. Carrying Channels: Base steel thickness of 0.0538 inch (fka 16 gauge), a minimum 1/2-inch wide flange, with ASTM A653, G40, or equivalent corrosive resistance.
 - 1. Depth: 1-1/2 inches, unless otherwise noted.
- D. (Contractor's Option) Grid Suspension System of Interior Ceilings: ASTM C645-07, manufacturer's standard direct-hung grid suspension system composed of the main beams and cross furring members that interlock to form a modular supporting network.
 - 1. Structural Classification:
 - a. Main beam shall be heavy duty per ASTM C635.
 - b. Classification can require wires to be closer together for additional loading when used to support double layer gypsum panels, verticals, slopes, circles, soffits, canopies, and stop conditions which call for loading or unusual designs and shapes in gypsum board construction.

- c. Deflection of fastening suspension system supporting light fixtures, ceiling grilles, access doors, verticals and horizontal loads shall have a maximum deflection of 1/360 of the span.

2.4 GYPSUM BOARD PRODUCTS

- A. General Requirements: Comply with ASTM C 1396. Provide in maximum lengths and widths available that will minimize joints in each area, that will minimize joints in each area, and that correspond with support system indicated.
 - 1. Unless otherwise noted all gypsum board shall be fire-resistance-rated. Refer to Code Plan in Construction Drawings for specific locations and requirements of fire-resistance-rated assemblies indicated.
 - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
 - 3. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
 - 4. Where building is not enclosed and environmental conditions cannot be maintained only interior extended exposure gypsum boards maybe used. Only setting type joint compounds may be used as well.
 - 5. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- B. Moisture-and Mold-Resistant Gypsum Boards: ASTM C 1396 with moisture and mold resistant core and surfaces.
 - 1. Core: 5/8 inch, Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.5 TILE BACKING BOARDS

- A. Glass-Mat, Water-Resistant Backing Board: Comply with ASTM C1178 or C1177.
 - 1. Core: 5/8 inch, Type X or C, unless otherwise noted.
 - 2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
- B. Cementitious Backer Board: Complying with ANSI A118.9 and ASTM C1288 or 1325 of thickness indicated and in maximum lengths available to minimize end-to-end butt joints. Ends and edges shall be square cut and finished smooth; formed in a continuous process of aggregated Portland-cement slurry; and reinforced with vinyl coated, woven glass-fiber mesh embedded in both surfaces.
 - 1. Thickness: Manufacturer's standard thickness, but not less than 7/16 inch, unless otherwise indicated.
 - 2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
- C. Water-Resistant Gypsum Backing Board per ASTM C1396 is not an acceptable substitute for any of the products hereinbefore specified.

2.6 ACOUSTICAL INSULATION MATERIALS

- A. Sound-Attenuation Blankets: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without facing membrane), unless noted otherwise.
 - 1. Mineral-Fiber Type: Fibers manufactured from glass, slag wool, or rock wool.
 - a. Where used in fire-resistance rated assemblies, mineral fiber types shall correspond with requirements of tested assemblies.
- B. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BOSS 826 Acoustical Sound Sealant; Accumetric LLC.
 - b. RCS 20 Acoustical; GE Construction Sealants.

- c. Acoustical Sealant GSC; Grabber Construction Products.
- d. OSI Pro-Series SC-175 Acoustical Sound Sealant; Henkel Corp.
- e. AC-20 FTR or AIS-919; Pecora Corp.
- f. Smoke-N-Sound Acoustical Sealant; Specified Technologies, Inc.
- g. Quiet Seal Pro; Serious Energy, Inc.
- h. SHEETROCK Acoustical Sealant; USG Corp.
- i. CP 506 Smoke and Acoustical Sealant; Hilti.
- j. Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: Franklin International.

C. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation".

2.7 MISCELLANEOUS MATERIALS

- A. General: Comply with ASTM C475 and C1396. Provide auxiliary materials that comply with referenced installation standards.
- B. Joint Tape: Tape shall be mold resistant and achieve a 10 rating when tested per ASTM D 3273.
 - 1. Interior Gypsum Board (Temperature/Humidity controlled): Paper.
 - 2. Tile Backing Boards (cementitious): As recommended by board manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats. Pre-mixed compounds shall be free of antifreeze, biocides, and other slow releasing compound. All-purpose type compound will not be acceptable for prefilling, embedding, and first coat.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type compound.
 - a. ProForm Brand Quick Set Lite Setting Joint Compound, by National Gypsum Company.
 - b. Sheetrock Brand Easy Sand Setting Type Joint Compound, by USG.
 - c. Comparable product approved by one of the gypsum board manufacturers listed.
 - 2. Level 2: Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type compound.
 - a. ProForm Brand Quick Set Lite Setting Joint Compound, by National Gypsum Company.
 - b. Sheetrock Brand Easy Sand Setting Type Joint Compound or Sheetrock Brand Plus 3 Lightweight by USG
 - c. Comparable product approved by one of the gypsum board manufacturers listed.
 - 3. Level 3: Fill coat, Second and Third Coat: For third coat, use all –purpose, midweight, topping, or lightweight compounds.
 - a. ProForm Brand Lite Blue Ready Mix or ProForm All Purpose with Dust-Tech Joint Compound, by National Gypsum Company.
 - b. Sheetrock Brand Plus 3 Lightweight or Ultra Lightweight All Purpose Joint Compound, by USG
 - c. Comparable product approved by one of the gypsum board manufacturers listed.
 - 5. Level 4: Finish Coat: For fourth coat, use all-purpose, midweight, topping, or lightweight compounds.
 - a. ProForm Brand Lite Blue Ready Mix or ProForm All Purpose with Dust-Tech Joint Compound, by National Gypsum Company.
 - d. Sheetrock Brand Plus 3 Lightweight or Ultra Lightweight All Purpose Joint Compound, by USG
 - e. Comparable product approved by one of the gypsum board manufacturers listed.
 - 6. Level 5: Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound, or a high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
 - a. Primer and its application to surfaces are specified in Division 09 Section "Interior Painting."
- D. Joint Compound for Cementitious Backer Board: Material recommended by cementitious backer unit manufacturer.

- E. Steel Screws for Gypsum Board: ASTM C1002, unless otherwise noted.
 - 1. Use screws complying with ASTM C954 for fastening boards to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by board manufacturer.
- F. Accessories for Interior Installation: Corner bead, edge trim, and control joints complying with ASTM C1047 and requirements indicated below:
 - 1. Material: Formed metal with metal complying with the following requirements:
 - a. Steel sheet zinc-coated by hot-dip or electrolytic process, or steel sheet coated with aluminum or rolled zinc, unless otherwise noted.
 - 1) Do not use plastic accessories, unless otherwise noted or approved by A/E in writing.
 - 2) Provide paper-faced galvanized steel sheet at abuse-resistant gypsum boards, where recommended by manufacturer.
 - 2. Shapes indicated below by reference to Figure 1 designations in ASTM C1047:
 - a. Corner Bead: Use at outside corners, unless otherwise indicated.
 - 1) For corner bead, a high strength tapered copolymer core, preformed, uniform, 90 degree angle trim may be used. Surface shall be tight fibered, formulated paperboard. Back shall be joint tape paper for uniform surface bonding.
 - a) Basis-of-Design: No-Coat; Ultratrim Outside 90.
 - b) Comparable Product: Clark Dietrich Straitflex OS-300 or Big Stick.
 - b. L-bead with face flange only; face flange formed to receive joint compound. Use for edge trim (perimeter relief).
 - 1) For L-bead, a high strength tapered copolymer core trim may be used. Surface shall be tight fibered, formulated paperboard. Back shall be joint tape paper for uniform surface bonding.
 - a) Basis-of-Design: No-Coat; Ultratrim – 1/2 L-Trim.
 - b) Comparable Product: Clark Dietrich Straitflex L-Bead.
 - c. LC-bead (J-shaped): Exposed long flange receives joint compound; use at exposed board edges.
 - d. One-piece control joint formed with V-shaped slot and removable strip covering slot opening.
- G. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gaskets: Closed-cell vinyl foam adhesive-backed strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit metal stud size indicated.
- H. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum boards to continuous substrate.
 - 1. Do not adhere gypsum board directly to CMU on an exterior wall.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section.
- B. Examine boards before installation. Reject boards that are wet, moisture damaged, and mold damaged.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLING SUSPENSION SYSTEMS, CEILINGS/SOFFITS

- A. Suspend hangers from building structure as follows:
 - 1. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
 - a. Flat Ceilings: Main tees shall be spaced a maximum of 48 inches on center and supported by hanger wires spaced a maximum 48 inches on center and as specified by UL Fire Resistance Directory attaching hanger wires directly to structure above. Do not attach to metal deck.
 - 1) Cross tees shall be spaced per manufacturers' recommendations and as specified by UL Fire Resistance Directory.
 - b. Transitions (changes in elevation in soffit and fascia ceiling applications): When constructing stepped soffits, bracing of the gypsum board suspension system and/or additional hanger wires might be necessary to ensure stability and structural performance during and after gypsum board attachment.
 - 1) The maximum vertical soffit height shall be 48 inches. (Maximum unsupported gypsum area shall not exceed 48 inches by 24 inches).
 - 2) Intermediate cross tees are not necessary when bulkhead dimensions do not exceed 24 inches.
 - 3) Cross tee spacing in horizontal soffit plane shall not exceed 24 inches.
 - 4) Intermediate cross tees might be necessary to maintain visually acceptable drywall planes and drywall corners.
- B. Installation Tolerances: Install suspension systems that are level to within 1/8-inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.3 SOUND-RATED CONSTRUCTION

- A. General: Install sound attenuation blankets in sound-rated partitions and ceilings.
- B. Interior-Partition Soundproofing
 - 1. Acoustical sealant shall be used to seal the entire perimeter of partitions having acoustical insulation as indicated on the Drawings, to seal cutouts in these partitions, and to seal under control joints. Sealant shall be installed in strict accordance with the manufacturer's written instructions. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
 - a. Cutouts include electrical boxes, recessed cabinets, heating ducts, and cold air returns. (Apply sealant on sides and backs of electrical boxes.)
 - 2. Acoustical insulation shall be inserted between studs and extend the full height of the soundproof partition.
 - a. Fit carefully behind electrical outlets and other work penetrating sound-rated construction.
- C. Acoustical Sealant:
 - 1. At partition walls, provide continuous beads of acoustic sealant at juncture of both faces of runners with floor and ceiling construction, and wherever gypsum board abuts dissimilar materials, prior to installation of gypsum board.
 - 2. At ceilings, provide continuous beads of sealant whenever gypsum board abuts dissimilar materials.
 - 3. Provide continuous bead of sealant behind faces of control joints prior to installation of control joint accessories.
 - 4. After installation of gypsum board base layers, cut face layer sheets 1/2 inch less than floor-to-ceiling height and position with 1/4 inch open space between gypsum board and floor, ceiling and dissimilar vertical construction. Fill 1/4 inch open space with continuous sealant beads after installation of face layer.

5. At openings and cutouts, fill open spaces between gypsum board and fixtures, cabinets, ducts and other flush or penetrating items, with continuous bead of sealant.

D. Sound Flanking Paths:

1. Where sound-rated partitions intersect non-rated gypsum board partition walls, extend sound-rated construction to completely close sound flanking paths through non-rated construction.
2. Seal joints between face layers at vertical interior angles of intersecting partitions.

3.4 APPLYING AND FINISHING BOARDS, GENERAL

A. Gypsum Board Application and Finishing Standards: Install and finish gypsum boards to comply with ASTM C840.

B. Work shall be provided in accordance with the manufacturer's printed instructions and as specified herein. Where fire-rating requirements for systems are indicated on the Drawings or in the schedules, install components in accordance with manufacturer's instructions to comply with indicated fire rating requirements.

1. Tolerances
 - a. Do not exceed 1/8 inch in 8 feet 0 inches variation from plumb or level in exposed lines of surface, except at joints between gypsum board units.
 - b. Do not exceed 1/16 inch variation between planes of abutting edges or ends.
 - c. Shim as required to comply with specified tolerances.

C. Wallboard joints shall be butted tightly together.

1. Install ceiling boards in direction, either parallel or perpendicular to framing members, which results in the least number of joints. Install in maximum practical lengths to span with minimum number of end (butt) joints. Stagger end joints of adjoining boards not less than one framing member.
2. Form control and expansion joints with space between edges of adjoining gypsum boards.
3. Attachment to Framing: Attach boards so leading edge or end of each board is attached to open (unsupported) edges of stud flanges first.
4. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide a minimum of 1/4-inch perimeter relief where board abuts different materials, including floors. Trim edges with U-bead edge trim, where edges of gypsum boards are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
5. Install gypsum boards with face-side out. Butt boards together for a light contact at edges and ends with not more than 1/16 inch of open space between boards. Do not force into place.
6. 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.
7. Cover both faces of steel-stud partition framing with gypsum boards in concealed spaces (above ceilings, etc.) except in chases braced internally or where gypsum board is specifically noted as being installed on only one side of steel-stud partition framing.
 - a. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq.ft in area.
 - b. Fit gypsum boards around ducts, pipes, and conduits.
 - c. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum boards to fit profile formed by joists, and other structural members; allow 1/4 to 3/8 inch wide joints to install sealant.

D. Wood Framing: Install gypsum boards over wood framing, with floating internal corner construction. Do not attach gypsum boards across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum boards over these members or provide control joints to counteract wood shrinkage.

- E. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- F. Install sound attenuation blankets before installing gypsum boards unless blankets are readily installed after boards have been installed on one side.

3.5 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Vertical Surfaces: Provide moisture-and-mold-resistant gypsum boards, unless otherwise noted.
 - 2. Horizontal Surfaces: Provide moisture-and mold-resistant gypsum boards, unless otherwise noted.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum boards before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum boards vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of boards.
 - b. Use maximum length boards to minimize end joints.
 - 3. Fastening Methods: Apply gypsum boards to supports with steel drill screws.
- C. Multilayer Application:
 - 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - 3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Openings cut in gypsum board to fit electrical outlets, plumbing, and piping shall fit snugly and shall be small enough to be covered by plates and escutcheons. Both face and back paper shall be cut for cutouts that are not made by use of a saw.
 - 1. Make necessary cut-outs and seal cut or exposed board edges as recommended by gypsum board manufacturer.
- E. Fasteners: Install fasteners no closer than 3/8 inch to end or edge. Space fasteners approximately 7 inches o.c., opposite each other on adjacent ends or edges. Begin fastening from center of wallboard and proceed toward outer end or edges.
- F. Apply pressure on gypsum board, adjacent to fasteners being driven, to insure that gypsum board will be secured tightly to framing member. Check for looseness at fasteners. Drive fastener with shank reasonably perpendicular to face of board.
- G. Drive screws with power screwdriver as recommended by gypsum board manufacturer. Surface of head shall be below surface of paper without cutting paper.

- H. Direct Bonding (laminating) to Substrate: Where gypsum boards are indicated as directly adhered to a substrate, comply with gypsum board manufacturer's recommendations, and temporarily brace or fasten gypsum boards until fastening adhesive has set.

3.6 APPLYING TILE BACKING BOARDS

- A. General
1. Complete plumbing rough-in before gypsum board boards are erected.
 2. Separate gypsum boards from rough-in and fixtures by 1/4 inch space.
 3. Make necessary cut-outs and seal cut or exposed board edges with thinned-down ceramic tile adhesive or with waterproof flexible sealant, as recommended by gypsum board manufacturer.
 4. Prior to tile application, fill openings around pipes, fittings, fixtures, interior angles and other penetrations with silicone sealant, as recommended by gypsum board manufacturer. Do not fill 1/4 inch gap at bottom of boards.
- B. Wall Tile Substrates: For substrates indicated to receive thin-set ceramic tile and similar rigid applied wall finishes, comply with the following:
1. Install glass-mat, water-resistant backing board boards to comply with board manufacturer's installation instructions, unless otherwise noted.
 2. Install cementitious backer units at showers, tubs, and at "wet" walls to comply with ANSI A108.11. Refer to Division 09 Section "Tile".
 3. Where tile backing boards abut other types of boards in same plane, shim surfaces to produce a uniform plane across board surfaces.

3.7 INSTALLING TRIM ACCESSORIES

- A. General: For trim with backflanges intended for fasteners, attach to framing with same fasteners used for boards. Otherwise, attach trim according to manufacturer's written instructions.
- B. Joint and corner treatment shall be in accordance with the manufacturer's printed instructions to provide a finished surface, ready for painting. Surface shall be free of dimples, excess finishing compound, ridges, or untrue corners.
1. Install edge trim where edge of gypsum boards would otherwise be exposed or semi-exposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.
- C. Provide control joints in gypsum board partitions, bulkheads, ceilings, and soffits according to ASTM C840 and as follows:
1. Partition, furring, abuts a structural element (except floor) or dissimilar wall or ceiling.
 2. Ceiling or soffit abuts a structural element, dissimilar wall or partition or other vertical penetration.
 3. Construction changes within plane of partition or ceiling.
 4. Partition or furring run exceeds 30 feet, unless noted otherwise.
 5. Ceiling dimensions exceed 40 feet in either direction.
 6. Wings of "L", "U", and "T"-shaped ceiling areas are joined.
 7. Expansion or control joints occur in the exterior wall.
 8. Less-than-ceiling-height frames should have control joints extending to the ceiling from both corners. Ceiling height door frames may be used as control joints. Treat window openings in same manner as doors.
 9. Control Joint: Apply over face of gypsum board where specified. Cut to length with a fine-toothed hacksaw (32 teeth per inch). Cut end joints square, butt together, and align to provide neat fit. Attach control joint to gypsum board with fasteners spaced 6 inches o.c. maximum along each flange. Remove plastic tape after finishing with joint compound or veneer finish.
 - a. Leave a 1/2-inch continuous opening between gypsum boards for insertion of surface-mounted joint.
 - b. Interrupt wood floor and ceiling plates with a 1/2-inch gap, wherever there is a control joint in the structure.

- c. Do not attach gypsum board to steel studs on one side of control joint.
- d. Provide separate supports for each control joint flange.
- e. Provide an adequate seal behind control joint where sound or fire ratings are prime considerations.

3.8 FINISHING GYPSUM BOARD ASSEMBLIES

- 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.
 - 1. Prefill open joints and damaged surface areas.
 - 2. Apply joint tape over gypsum-board joints, except those with trim having flanges not intended for tape.
 - 3. Joint tape and setting compounds shall not reduce moisture and mold resistance of gypsum wallboard assembly.
 - 4. Coats of non-setting type components shall be thoroughly dry before sanding of the application of additional coats.
- B. Levels of Finish: The following levels of finish are established as a guide for specific final finishes in accordance with GA-214 and ASTM C840, for locations as indicated.
 - 1. Level 0: No taping, finishing, or accessories required.
 - a. This level of finish shall be used in temporary construction only.
 - 2. Level 1: Joints and interior angles shall have tape embedded in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
 - a. This finish level shall be used in plenum areas above ceilings, in attics, and in areas where the assembly is concealed.
 - b. Where a fire-resistance rating is required for the gypsum board assembly, details of construction shall be in accordance with reports of fire tests of assemblies that have met the fire-rating requirement. Tape and fastener heads need not be covered with joint compound.
 - 3. Level 2: All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
 - a. This level may be used as a substrate for tile.
 - 4. Level 3: All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. One additional coat of joint compound shall be applied over all joints and interior angles. Fastener heads and accessories shall be covered with two separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Surface shall be covered with primer prior to the application of the final decoration.
 - a. This level may be used at areas to receive heavy- or medium-texture (spray or hand applied) finishes before final painting, or where a heavy-grade wall covering is to be applied as final decoration.
 - 5. Level 4: All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied over all flat joints and one separate coat of joint compound shall be applied over interior angles. Fastener head and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges.
 - a. This level is to be used at areas to receive flat paints, eggshell and semi-gloss paints, light textures, or wall coverings are to be applied.

6. Level 5: All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied over all flat joints and one separate coat of joint compound shall be applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.
 - a. This level is to be used at areas to receive gloss paint and areas subject to severe lighting, where indicated.

C. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.9 REPAIR

- A. General: Finishing of gypsum wallboard assemblies often requires patches and repairs of existing walls or corrections to errors made in erecting new work.
 1. Coordinate patching and repair work with work of Division 09 Section "Interior Painting".
 2. Repair and patch as recommended by gypsum wallboard manufacturer.
 - a. Small holes use a patching or setting compound as recommended by manufacturer.
 - b. For larger holes up to 12 inches reinforce patch with fiberglass tape.
 - c. For even larger opening gypsum repair clips may be incorporated.
 3. Where ceilings and walls are badly disfigured, a fresh surface maybe desirable. The wall can be resurfaced with a layer of 1/4 inch or 3/8 inch gypsum boards.
 - a. Preparation: Remove all loose surfacing material and trim if necessary to create a smooth surface. Fill small holes with joint compound or patching compound. Patch large holes to the surrounding level with single or multiple layers of gypsum board attached to framing and shimmed out as required.
 - 1) Where large irregularities of surface exist, apply furring strips not over 16 inch o.c. using wood shims to shim out to a true even plane.
 - 2) Electrical outlet boxes for switches, wall receptacles and fixtures should be extended outward to compensate for the added gypsum board thickness.
 - b. Install boards as recommended by gypsum manufacturer and as noted hereinbefore.

3.10 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 boards that are wet, moisture-damaged, and mold-damaged.
 1. Indications that boards are wet or moisture-damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that boards are mold-damaged include, but are not limited to fuzzy or splotchy surface contamination and discoloration.

3.11 FIELD QUALITY CONTROL

- A. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

- B. Above Ceiling Observation: Before Contractor installs gypsum board ceilings, A/E will conduct an above ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
1. Notify A/E 7 days in advance of date and time when project, or part of project, will be ready for above-ceiling observation.
 2. Before notifying A/E, complete the following in areas to receive gypsum board ceilings:
 - a. Installation of 80 percent of lighting fixtures, powered for operation.
 - b. Installation, insulation, and leak and pressure testing of water piping systems.
 - c. Installation of air duct systems.
 - d. Installation of ceiling support framing.

END OF SECTION 09 21 16.00

SECTION 09 30 00 - TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes following:
 - 1. Porcelain tile.
 - 2. Ceramic wall tile.
 - 3. Waterproof membrane for tile installations.
 - 4. Metal edge strips installed as part of tile installations.
- B. Related Sections include following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates, admixtures, and topping that may affect performance of installed tile.
 - 2. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 3. Division 09 Section "Gypsum Board Assemblies" for cementitious backer units and glass-mat, water-resistant backer board.

1.2 DEFINITIONS

- A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Conduct meeting at Project site. A/E will schedule and conduct meeting.
 - 1. Review mockup.
 - 2. Review requirements in ANSI 108.01 for substrates and for preparation by other trades.
 - 3. Flooring product manufacturer will have a technical installation representative available at job site at inception of installation to insure there are no conditions which will compromise installation of material and that material is being installed according to industry standards, practices and manufacturers guidelines. Manufacturer's technical representative will document and confirm that substrate, material, and installation are in compliance with manufacturer's guidelines and accepted industry standards and practices.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Qualification Data: For Installer.

- B. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.

1.5 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: Include cleaning methods, cleaning solutions recommended, stain removal methods, and polishes and waxes recommended.
 - 2. Receipt for verification of extra stock.

1.6 MAINTENANCE MATERIALS

- A. Furnish extra materials as installed. Leave, at Project where directed, any remaining full size pieces of each type, color, pattern, and size for Owner's maintenance.

1.7 QUALITY ASSURANCE

- A. Installers Qualifications: Work done under this Section of Specifications shall be performed by mechanics skilled and experienced in class of work involved. Workmanship shall be in accordance with best trade practices, and surface shall be true to line and free from waves and other imperfections. Joints between tiles shall be maintained uniform and even and properly grouted.
 - 1. Installers shall be experienced in ANSI A108 standards and Tile Council of North America (TCNA) recommendations. A copy of these standards shall be present at jobsite.
 - 2. Install shall meet one or more of following qualifications:
 - a. Installer is a five-star member of National Tile Contractors Association or a Travel of Excellence member of Tile Contractors' Association of America.
 - b. Installer's supervisor for Project holds International Masonry Institute's Foreman Certification.
 - c. Installer employs Ceramic Tile Education Foundation Certified Installers.
 - d. Installer employs at least one installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification for installation of large format tile.
 - 3. Foreman: It is recommended that a non-working project foreman be on-site, overseeing the work and implementing their Quality Control Plan.
- B. Regulatory Requirements:
 - 1. TCNA Handbook for Ceramic Tile Installation by Tile Council or North America, latest edition.
 - 2. American National Standard Specifications for Installation of Ceramic Tile.
- C. Mockups: First-in-place 25 sq.ft. shall serve as mockup. Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Mockup is to be viewed in lighting to which it will be subjected.
 - 1. Build mockup of floor tile installation.
 - 2. Build mockup of wall tile installation.
 - 3. Subject to compliance with requirements, approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.
 - a. Do not proceed with remaining work until workmanship, color, and sheen are approved by A/E. Obtain A/E's acceptance of mockups before start at final unit of work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at levels indicated in referenced standards and manufacturer's written instructions.
- B. Protection: Protect adjacent work surfaces during tile work. Close rooms or spaces to traffic, of all types, until mortar and grout have set.
- C. Safety: Observe manufacturer's safety instructions including those pertaining to ventilation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, following requirements apply for product selection:
 - 1. Products: Subject to compliance with requirements, provide one of products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
 - 3. Basis-of-Design Product: Design for each tile type is based on product named. Subject to compliance with requirements, provide either named product or a comparable product by one of other manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. Requests for Architect/Engineer's approval must be accompanied by "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
 - 1. Where products are indicated on List of Finishes with color selected, provide sample or color chart to verify color match with substitution request.
- C. Source Limitation for Surface Prep, Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, self-leveling underlayments, waterproofing/crack isolation fluid membrane and grout component from single manufacturer and each aggregate from single source or producer.
 - 1. Obtain self-leveling underlayments, waterproofing/crack isolation fluid membrane setting and grouting materials, except for unmodified Portland cement and aggregates, from single manufacturer.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1/2, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
 - 2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

- 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. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with following requirements:
 - 1. Refer to "List of Finishes".
- D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, 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.
- E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
- F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

- A. Unglazed Porcelain Tile (PT): Flat tile as follows:
 - 1. Composition: Impervious natural clay or porcelain.
 - 2. Facial Dimensions: As indicated.
 - 3. Face Size Variation: Rectified.
 - 4. Thickness: 3/8 inch.
 - 5. Face: Plain with cushion edges, unless otherwise noted.
 - 6. Dynamic Coefficient of Friction: Not less than 0.42.
 - 7. For latex-portland cement-mortared and -grouted paver tile, precoat with temporary protective coating.
 - 8. Basis-of-Design Product: Refer to "List of Finishes"
- B. Ceramics Wall Tile (CWT): Flat tile as follows:
 - 1. Module Size: As indicated.
 - 2. Face Size Variation: Rectified.
 - 3. Thickness: 5/16 inch.
 - 4. Face: Plain with cushion edges, unless otherwise noted.
 - 5. Finish: Bright, opaque glaze, unless otherwise noted.
 - 6. Mounting: Factory back-mounted.
 - 7. Basis-of-Design Product: Refer to "List of Finishes"
- C. Glazed Wall Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
 - 1. Base for Thin-Set Mortar Installations: Straight.
 - 2. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose.
 - 3. External Corners for Thin-Set Mortar Installations: Surface bullnose.
 - 4. Internal Corners: Field-buttet square corners except with coved base and cap angle pieces designed to fit with stretcher shapes.

2.4 WATERPROOFING ONLY MEMBRANES FOR TILE INSTALLATIONS

- A. General: Manufacturer's standard product, selected from following that complies with ANSI A118.10 and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.
 - 1. Provide waterproofing at showers that do not have a prefabricated receptor.

- B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch nominal thickness.
1. Product: Noble Company; Nobleseal TS/Deck.
- C. PVC Sheet: Two layers of PVC sheet heat-fused together and facings of nonwoven polyester; 0.040-inch nominal thickness.
1. Product: Compotite Corporation; Composeal Gold.
- D. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008 inch nominal thickness.
1. Schluter Systems L.P.; KERDI
 2. Custom Building Products: Spider Web II Uncoupling Mat.
 3. SK175; ARDEX.
 4. ValueSeal: Noble Company
- E. Fabric-Reinforced, Modified-Bituminous Sheet; Self-adhering, SBS-modified-bituminous sheet with woven reinforcement facing; 0.040-inch nominal thickness.
1. Products:
 - a. Boiardi Products Corp.; Elastiment 350 Sound Control Sheet Membrane Waterproofing and Anti-Fracture/Crack Suppression System.
 - b. National Applied Construction Products, Inc., Strataflex.
 - c. MAPEI Corp.; Mapeguard C1 with Prime HM and Mapetepe BB at seams.
- F. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
1. Products: Subject to compliance with requirements, provide one of following:
 - a. Boiardi Products; a QEP company; Elastiment 344 Reinforced Waterproofing and Anti-Fracture/Crack Suppression Membrane.
 - b. Bostik, Inc.; Hydroment Blacktop 90210.
 - c. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
 - d. Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane.
 - e. MAPEI Corporation; Mapelastic 400 or Mapelastic HPG with MAPEI Fiberglass Mesh.
 - f. Mer-Kote Products, Inc.; Hydro-Guard 2000.
 - g. Southern Grouts and Mortars, Inc.; Southcrete 1100 Crack Suppression.
 - h. HB Fuller; TEC HydraFlex Waterproofing Membrane
- G. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
1. Products: Subject to compliance with requirements, provide one of following:
 - a. Boiardi Products; a QEP Company; Elastiment 644 Membrane Waterproofing System.
 - b. Bostik, Inc.; Durabond D-222 Duraguard Membrane.
 - c. C-Cure; Pro-Red Waterproofing Membrane 63.
 - d. Custom Building Products; Redgard Waterproofing and Crack Prevention Membrane.
 - e. Jamo Inc.; Waterproof.
 - f. Laticrete International, Inc.; Latapoxy 24 Hour HydroProofing.
 - g. MAPEI Corporation; Mapelastic AquaDefense.
 - h. Southern Grouts & Mortars, Inc.; Southcrete 1132 Waterproofing.
 - i. HB Fuller; TEC HydraFlex Waterproofing Crack Isolation Membrane.
 - j. Ardex Americas; Ardex S 1-K One-Component Waterproofing Compound.
 - k. National Applied Construction Products, Inc.; SubSeal Liquid Waterproofing Membrane.
- H. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
1. Products: Subject to compliance with requirements, provide one of following:
 - a. Boiardi Products; a QEP company; Elastiment 323 Cement Based Waterproofing, Anti-Fracture/Crack Suppression Membrane.
 - b. C-Cure; UltraCure 971.
 - c. MAPEI Corporation; Mapelastic 315.

- d. TEC; a subsidiary of H. B. Fuller Company; Triple Flex Waterproofing, Crack Isolation Membrane & Mortar.
- e. Ardex Americas; Ardex 8 + 9 Waterproofing Compound.
- f. HB Fuller; TEC Triple Flex Waterproofing Crack Isolation Membrane.

2.5 SETTING AND GROUTING MATERIALS

- A. Products: Subject to compliance with requirements, provide one of following:
- 1. Standard Dry Set Mortars: ANSI A118.1
 - a. Bostik; Tile-Mate Floor & Wall (712/762)
 - b. C-Cure; 911 Thinset
 - c. Laticrete; Laticrete 272
 - d. Mapei; Kerabond
 - e. HB Fuller; TEC Full Set Plus
 - f. Custom Building Products; CustomBlend – Standard Thin-Set
 - g. DAP; Durabond Thin-Set Mortar
 - h. Southern Grouts & Mortars; Thin Set Mortar 726/727
 - i. Summitville Tiles; Thin Set Mortar
 - 2. Nonsagging Dry-Set Mortars: ANSI A118.4
 - a. ARDEX Engineered Cements; X77 Microtec Fiber Reinforced Mortar
 - b. C-Cure; Perma Bond Non-Sag 903
 - c. Custom Building Products, ProLite Tile and Stone Mortar
 - d. MAPEI; Keraflex Plus
 - e. HB Fuller; TEC Ultimate 6 Plus/TotalFlex 110 Silica Free Universal Mortar
 - f. Modified Dry-Set Mortar (Thinset): ANSI A118.4 (Large and Heavy Tile Mortar)
 - g. ARDEX Engineered Cements; X77 Microtec Fiber Reinforced or X32 Microtec Rapid Setting Thin-to-Thick Bed Mortar
 - h. Bostik; Hydroment
 - i. C-Cure; 911 Thinset/939 Cure Crylic Premium
 - j. Laticrete; Laticrete 272 Premium/3701/333
 - k. MAPEI; Keraflex Plus
 - l. Custom Building Products; Complete Contact Fortified Thin-Set
 - m. Boiardi Products; Elastiment/102/753
 - n. DAP; Durabond/DBL16/DBL36
 - o. Southern Grouts and Mortars; Thinset Mortar 726/727/Southcrete 25/28
 - p. Summitville Tiles; SB777 Thin Set Mortar/SB800/SB810
 - 3. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15
 - a. HB Fuller; TEC Super Flex or TotalFlex 110 Silica Free Universal Mortar
 - b. Custom Building Products; Flexbond-LFT Premium Crack Prevention Large Format Tile Mortar
 - c. LATICRETE SUPERCAP, LLC; 4-XLT
 - d. MAPEI Corporation; Keraflex Plus
 - 4. Polymer-Modified, Unsanded Tile Grout: ANSI A118.7
 - a. ARDEX Engineered Cements; FG-C Microtec Unsanded Floor and Wall Grout/Grout Booster
 - b. Bostik; Hydroment (Unsanded)/425
 - c. C-Cure; Supreme 925/MP 923/CureCylic 938/Color Cure 945
 - d. DAP; Durabond C150/Durabond DBL26
 - e. Laticrete; 600 Series/LATICRETE 1776
 - f. MAPEI; Keracolor U/Ultra Care Grout Maximizer
 - g. Southern Grouts & Mortars; Dry-Set Grout Unsanded Polymer Modified Tile Grout/Southcrete 20 Acrylic Admix
 - h. Summitville Tiles; SB687/SB775
 - i. HB Fuller; TEC Unsanded AccuColor/TA Acrylic Grout Additive
 - j. Custom Building Products; Polyblend Non-Sanded Tile Grout/Stain Blocker Additive

5. Polymer-Modified, Sanded Tile Grouts: ANSI A118.7
 - a. Bostik; Vivid
 - b. C-Cure
 - 1) AR Sanded Grout 922/MP Sanded 924
 - 2) CureCrylic 938
 - c. Laticrete: Permacolor Select
 - d. MAPEI, Keracolor S
 - e. HB Fuller:
 - 1) Power Grout
 - 2) AccuColor Plus
 - f. Custom Building Products: Polyblend Plus Sanded Grout
 - g. DAP; Durabond ARB20/Durabond DBL26
 - h. Southern Grouts & Mortars; Saltillo Grout Mix/Southcrete 20 Acrylic Admix
 - i. Summitville Tiles; SB700/SB775 or SB776
 - j. ARDEX Americas: FL Rapid Set, Flexible, Sanded Grout

- B. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
 1. For wall applications, provide nonsagging mortar that complies with Paragraph C-4.6.1 in addition to other requirements in ANSI A118.1.
- C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of following:
 1. Prepackaged dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive.
- D. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.
 1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added to Project site.
 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.15.
- E. Organic Adhesive: Not acceptable.
- F. Polymer-Modified, High-Performance, Tile Grout: ANSI A118.7, color as indicated.
 1. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
 - a. Unsanded grout mixture for joints 1/8 inch and narrower.
 - b. Sanded grout mixture for joints 1/8 inch and wider.

2.6 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 07 Section "Joint Sealants."
 1. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
 1. Products:
 - a. Dow Corning Corporation; Dow Corning 786.
 - b. GE Silicones; Sanitary 1700.
 - c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
 - d. Tremco, Inc.; Tremsil 600 White.
 - e. Laticrete International, Inc., Latasil Tile and Stone Sealant.
 - f. MAPEI, Mapesil

- g. ARDEX Engineered Cements; SX 100% Silicone Sealant.
 - h. Custom Building Products: Commercial 100% Silicone Sealant.
 - i. HB Fuller; TEC AccuColor 100% Silicone Sealant.
- D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
- 1. Products:
 - a. Bostik; Chem-Calk 550.
 - b. Degussa Building Systems; Sonneborn Sonolastic SL-2.
 - c. Pecora Corporation; NR-200 Urexpan/Dynatrol II-SG.
 - d. Tremco, Inc.; THC-900/THC-901.
 - e. Sika Corporation; Sikaflex – 2cSL.
 - f. MAPEI; Planipatch.

2.7 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: ANSI A118.16 or ANSI A108.21; latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, white zinc alloy or stainless steel; ASTM A 666, 300 Series exposed-edge material.
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of following:
 - a. Blanke Corporation
 - b. Ceramic Tool Company, Inc.
 - c. Schluter Systems L.P.
 - d. Profloor Series: Custom Building Products.
- C. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
- 1. Petroleum paraffin wax, fully refined and odorless, contains at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
 - 2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Floor/Grout Sealer: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.
- 1. Products:
 - a. Bonsal, American, an Oldcastle company.
 - b. Bostik; CeramaSeal Grout Sealer.
 - c. C-Cure; Penetrating Sealer 978.
 - d. Custom Building Products; Grout Aqua Mix Sealer's Choice Gold.
 - e. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
 - f. Summitville Tiles, Inc.; SL-15; Invisible Seal.
 - g. MAPEI; Ultra Care Grout Sealer.

2.8 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.

2.9 SOURCE QUALITY CONTROL

- A. Manufacturer Services: Manufacturer assures product submitted is appropriate for application and environment in which it is to be installed and that product is merchantable for service, free of visible and latent defects and will perform for purpose for which it is intended without compromise.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify substrate mix design for additives i.e. hardeners, moisture vapor reduction admixture, and other ingredients that might affect performance of installed tile.
 - 2. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films or silicones, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
 - 3. Verify that concrete surfaces for tile floors installed with bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.1 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 4. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
 - 5. 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 and manufacturer has approved substrate for material to be installed without compromise.

3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials, using mechanical methods recommended by manufacturer. Do not use solvents.
- B. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
 - 1. For tiles with all edges shorter than 15 inches, maximum allowable variation in tile substrate is 1/4 inch in 10 feet from required plane, with no more than 1/16 inch variation in 1 foot when measured from high points of surface.
 - 2. For tiles with at least one edge 15 inches in length or longer, maximum allowable variation in tile substrate is 1/8 inch in 10 feet from required plane, with no more than 1/16 inch variation in 2 feet when measured from high points of surface.
 - 3. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
 - 4. Remove protrusions, bumps, and ridges by sanding or grinding.
 - 5. All concrete substrates at least 28 days old, completely cured and free of hydrostatic conditions.

- C. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- D. Wall and Ceiling Preparation: Comply with ANSI A108.01, Section 2.5.
 - 1. Gypsum board shall be installed per guidelines of ANSI A108.01, Section 3.5.
- E. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, 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.
- F. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules and apply to types of setting and grouting materials used.
 - 1. Tile and installation products must be installed per manufacturers' instructions and industry standards. Products should be mixed per manufacturers' instructions. Temperature limitations must not be exceeded, and shading or heat must be given as required. Work must also be protected from both weather and other trades.
- B. TCNA Installation Guidelines: TCNA's "Handbook for Ceramic Tile Installation." Comply with TCNA installation methods indicated in ceramic tile installation schedules.
 - 1. Lay out tilework so as to minimize cuts less than one-half tile in size. Do not interrupt pattern through openings, unless otherwise noted. No staggered joints will be permitted.
 - 2. Locate cuts in both walls and floors so as to be least conspicuous.
 - 3. Align floor joints to give straight uniform grout lines parallel with walls. Align joints between floor and base tile. Align joints in both directions. Create transitions to other material or colors under door, unless otherwise noted.
- C. 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.
- D. 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.
 - 1. Form internal angles square and external angles bullnosed, unless otherwise noted.
- E. Provide manufacturer's standard trim shapes where necessary to eliminate tile edges, unless otherwise noted.
- F. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- G. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where tiles are specified or indicated to be whole integer multiple of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

3. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.

H. Lay out tile wainscots to next full tile beyond dimensions indicated.

I. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
3. Control joints and other sealant usage
 - a. Install control joints where tile abuts retaining surfaces such as perimeter walls, curbs, columns, wall corners, and directly over cold joints and control joints in structural surfaces conforming to architectural details.
 - b. Install control joint in floors at spacings as indicated in TCNA Installation Handbook, unless noted otherwise.
 - c. Rake or cut control joints through setting bed to supporting slab or structure. Keep joints free of mortar.
 - d. Install in accordance with TCNA Installation Handbook.
 - e. Fill joints with self leveling polyurethane sealant and backing material specified in Division 07 Section "Joint Sealants".
 - f. Fill joints around toilet fixtures with white silicone sanitary sealant. Refer to Division 07 Section "Joint Sealants".
4. Expansion Joints
 - a. Keep expansion joints free of mortar and grout.
 - b. Use manufacturer's expansion joint flashing when covering expansion joints with waterproofing or crack-suppression membranes.
 - c. Provide expansion joints directly over changes in material, over control and expansion joints in substrate, at juncture of floors and walls, at other restraining surfaces such as curbs, columns, bases, and wall corners, and where recommended by TCNA EJ171 Expansion Joint requirements.
 - d. Install sealant in expansion joints.
 - e. Provide sealant material at items penetrating tile work, unless otherwise indicated.
 - f. Provide sealants and related materials in accordance with cited ANSI and TCNA requirements.

J. Grout tile to comply with requirements of following tile installation standards:

1. For ceramic tile grouts (polymer-modified tile grouts), comply with ANSI A108.10.

K. At "wet walls" i.e. showers, tubs, and where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.

1. Shower pan membranes shall extend 3 inches minimum above finished floor to form pan, unless otherwise noted.
2. Materials adversely affected by moisture in areas immediately adjacent to showers or tubs shall be properly protected.
3. All horizontal surfaces, for example shower seats, sills, curbs, etc. must slope towards drain or other surfaces sloped toward drain. Waterproofing must also be sloped.
4. For curbless shower receptor, refer to TCNA B421C and B422C.

B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

- C. Do not interfere with drain's weep holes.

3.5 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in Floor Tile Installation Schedule, including those referencing TCNA installation methods and ANSI A108 Series of tile installation standards.
 - 1. Thin set method, floors and walls, general
 - a. Apply mortar with notched trowel using scraping motion to work material into good contact with surface to be covered. Maintain 90 percent coverage on back of tile and fully bed all corners, unless otherwise noted.
 - 1) For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
 - a) Tile floors in wet areas, i.e., showers, drying areas.
 - b) Tile floors consisting of tiles 8 by 8 inches or larger.
 - c) Tile floors composed of rib-backed tiles.
 - b. Apply only as much mortar as can be covered within allowable windows as recommended by mortar manufacturer or while surface is still tacky.
 - c. When installing large tiles, ceramics or mosaics, trowel small quantity of mortar onto back of each tile or sheet of tiles.
 - d. Set tiles in place and rub or beat with small beating block.
 - e. Beat or rap tile to ensure proper bond and also to level surface of tile.
 - f. Align tile to show uniform joints and allow to set until firm.
 - g. Clean excess mortar from surface of tile with wet cheese cloth (not a sponge) while mortar is fresh.
 - h. Allow face mounted tile to set until firm before removing paper and before grouting.
 - i. Sound tile after setting. Replace hollow sounding tiles.
 - 2. Bonding large format tile for coverage and support
 - a. Following installation techniques are required to ensure 95 percent coverage of bonding surface of larger tiles and provide full support of edges and corners, in accordance with procedures in ANSI A108 Series tile installation standards. Large tiles are generally considered to be 8 by 8 inch and greater.
 - 1) Select a notched trowel sized to facilitate proper coverage.
 - 2) Key mortar into substrate with flat side of trowel.
 - 3) Comb with notched side of trowel in one direction.
 - 4) Firmly press tiles into mortar and move them perpendicularly across ridges, forward and back approximately 1/8 to 1/4 inch to flatten ridges and fill valleys.
 - 5) This method can produce maximum coverage, with corners and edges fully supported, without backbuttering or beat in.
 - 6) Periodically remove and check a tile to assure proper coverage is being attained.
 - 7) Sound tile after setting. Replace hollow sounding tile.
- B. Joint Widths: Install tile on floors with following joint widths:
 - 1. Ceramic Mosaic Tile: 1/16 inch or manufacturers recommendation.
 - 2. Porcelain Tile: 3/8 inch or manufacturers recommendation.
- C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
 - 1. Locate transition under doors, unless otherwise noted.
- D. Floor/Grout Sealer: Apply grout sealer to cementitious grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.6 WALL (BASE) TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in Wall Tile Installation Schedule, including those referencing TCNA installation methods and ANSI setting-bed standards.
- B. Joint Widths: Install tile on walls with following joint widths:
 - 1. Ceramic Mosaic Tile: 1/16 inch.
 - 2. Ceramic Wall Tile: 1/16 inch.

3.7 ADJUSTING/CLEANING AND PROTECTING

- 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 latex-portland cement grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - 3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
- C. 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. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- D. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- E. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.8 INTERIOR, FLOOR TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor
 - 1. Tile Installation (FTI-G): Interior floor installation on waterproof membrane over concrete; thin-set mortar; TCNA F122 or TCNA F122A and ANSI A108.13.
 - a. Tile Type: Porcelain tile.
 - b. Thin-Set Mortar: Improved modified dry-set mortar.
 - c. Grout: Polymer-modified, high-performance, sanded grout.
 - d. Waterproof membrane as specified.

3.9 INTERIOR, WALL (BASE) TILE INSTALLATION SCHEDULE

- A. Interior Wall Installations, Wood or Metal Studs or Furring:
 - 1. Tile Installation (WTI-C): Interior wall installation over cementitious backer units; thin-set mortar; TCNA W244C and ANSI A108.5.
 - a. Tile Type: Ceramic wall tile.
 - b. Thin-Set Mortar: Improved modified dry-set mortar as recommended by manufacturer for application indicated.
 - c. Grout: Polymer-modified, high-performance, unsanded grout.

2. Tile Installation (WTI-D): Interior wall installation over glass-mat, water-resistant backer board; thin-set mortar; TCNA W245 or W248 and ANSI A108.5.
 - a. Tile Type: Ceramic wall tile.
 - b. Thin-Set Mortar: Improved modified dry-set mortar as recommended by manufacturer for application indicated.
 - c. Grout: Polymer-modified, high-performance, unsanded grout.
- B. Wet Bathtub/Shower Wall Installations:
 1. Tile Installation (WTI-H): Interior wall and shower-receptor installation over cementitious backer units; thin-set mortar; TCNA B415, TCNA W244, and ANSI A108.5.
 - a. Tile Type: Glazed ceramic wall tile.
 - b. Thin-Set Mortar: Improved modified dry-set mortar as recommended by manufacturer for application indicated.
 - c. Grout: Polymer-modified, high-performance, unsanded grout.
 - d. Waterproof Membrane: ANSI A108.13.

END OF SECTION 09 30 00

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes acoustical panels and exposed suspension systems for ceilings and acoustical ceiling clouds.

1.2 DEFINITIONS

- A. AC: Articulation Class.
- B. CAC: Ceiling Attenuation Class.
- C. LR: Light Reflectance coefficient.
- D. NRC: Noise Reduction Coefficient.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- B. Preinstallation Conference: Conduct conference at Project site.
 - 1. Agenda shall include project conditions, coordination with work of other trades, layout of items which penetrate ceilings.
- C. Sequencing
 - 1. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generated activities and wet work have terminated, and overhead work is completed, tested, and approved.
 - 2. Install acoustic units after interior wet work is dry.
 - 3. Ensure that products of this Section are supplied to affected trades in time to prevent interruption of construction progress.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including:
 - 1. Preparation instructions and recommendations.
 - 2. Dimensions, load carrying capacity, and performance standards compliance.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation and maintenance instructions.
- B. Tile Samples: Do not submit.

1.5 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For finishes to include in maintenance manuals.
 - 2. Receipt of extra materials.

1.6 EXTRA (MAINTENANCE) MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
 - 2. Hold-Down Clips: Equal to 2 percent of quantity installed.
- B. Replacement Stock: In addition to the maintenance stock specified above, provide extra replacement stock of acoustical materials, consisting of a minimum of one percent of area of each size, type, and thickness installed on the job. This extra stock is for replacement of damaged materials during the 60-day period following Substantial Completion, when the Owner's agent cannot ascertain the party responsible for the damage. Replacement stock that is not used shall be furnished to the Owner as extra materials.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain acoustical panel ceiling and suspension system from one source from a single manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages 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.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, 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.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - 1. Acoustical Tile Products
 - a. Armstrong World Industries
 - b. USG Interior Systems
 - c. CertainTeed Ceilings
 - 2. Suspension System Products
 - a. Armstrong World Industries
 - b. USG Interior Systems
 - c. CertainTeed Ceilings
 - 3. Trim and Accessories
 - a. Armstrong World Industries
 - b. USG Interior Systems
 - c. Gordon, Inc.
 - d. Fry Reglet Corporation
 - e. MM Systems, Inc.

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Performance Requirements: Panels shall meet the following minimum performance criteria:
 - 1. ASTM E1264, Class A materials.
 - 2. Moisture Resistant: No visible sag at of 90-percent relative humidity and 104 degrees F.
- B. Kitchens and associated rooms (storage, locker, and toilet) excluding classrooms and halls require aluminum, aluminum faced galvanized steel or stainless steel grid and lay-in panels with smooth, unperforated vinyl, polyester film (Mylar), or similar surface.
- C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
 - 1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
 - a. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance's, unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by A/E from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- C. Panel Characteristics: Comply with "Acoustical Ceiling Product Schedule" at the end of this section.
- D. Humidity Resistance: Where indicated in "Acoustical Panel Ceiling Product Schedule," panels shall be dimensionally stable at up to 100 percent relative humidity at temperatures ranging from 32 to 104 deg F. without having to acclimatize tiles.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Cast-in-place, postinstalled expansion, or postinstalled bonded anchors.
 - b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition, unless otherwise noted.
 - 2. Power-Actuated Fasteners in Concrete: Not allowed.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper, unless otherwise noted.
 - 2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch diameter wire.
 - 3. At clouds provide the following installation hardware items to conceal/minimize hangers (installation kit):
 - a. Strong Backs: Hot dipped galvanized cold rolled steel, caring channel, cut length to accommodate installation of cable 24 inches from edge of cloud.
 - b. Cable Hardware: 2-1/16 inches by 1 inch by 3/8 inch quick loop where clamp for 1/16 inch diameter cable.
 - 1) Hardware shall be capable of supporting 200 lbs.
 - c. Cable: 7 by 7 aircraft cable, 1/16 inch by 120 inch galvanized with loop at one end.
- E. Hanger Rods or Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch thick, galvanized steel sheet complying with ASTM A 653, G90 coating designation; with bolted connections and 5/16-inch diameter bolts.
- G. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

2.5 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

- A. 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 according to ASTM A 653, not less than G30 coating designation, with prefinished 15/16-inch wide metal caps on flanges.
 - 1. Structural Classification: Intermediate duty system.
 - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: Steel or aluminum cold-rolled sheet.
 - 5. Cap Finish: Painted white, unless otherwise noted.
 - 6. Provide this suspension system unless otherwise noted.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. 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 design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
 - 1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that 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.
 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
 4. Provide radiused corner edge molding trim at bullnose block.
- B. Suspension (Perimeter) Trim: 4 inch wide face, 9/16-inch horizontal legs with hems formed for attachment to the mounting clip; commercial quality cold-rolled 24-gauge steel, factory finished in based enamel paint finish, on all exposed surfaces.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - a. Axiom Trims and Transitions; Armstrong World Industries.
 - b. Compasso Standard; USG Interior Systems.
 - c. Cloud Perimeter Trim; CertainTeed Ceilings.
 - d. Infinity; Rockfon.
 2. Splice Plate: Steel in finish to match trim pans; formed for snap-fit into pan ends.
 3. Attachment Clips: Hot-dipped galvanized steel in finish to match pans formed for snap-fit into pan and attached to suspension system members.
 4. Corner Trim Pieces: To match trim.
 5. Trim shall be straight and/or curved as indicated.
 6. Color: Match adjacent suspension system.
- C. Concealed Suspension accessories:
1. Provide manufacturer's standard accessories for concealed suspension system installation.
 - a. Fixture trim kits.
 - b. Border clips.
 - c. Hold down clips.
 - d. Spring border clips.
 - e. Midpoint clips.

2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, non-staining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Pecora Corporation; AC-20 FTR or AIS-919.
 - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.
 - f. GE Construction Sealants; RCS20 Acoustical
 - g. Henkel Corp.; OSI Pro-Series SC-175 Acoustical Sound Sealant.
 - h. Serious Energy Inc.; Quiet Seal Pro.

PART 3 - EXECUTION

3.1 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.

3.2 PREPARATION

- A. General: Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the Project Conditions.
- B. 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, and comply with layout shown on reflected ceiling plans.
- C. Refer to Room Finish Schedule, Legend and Reflected Ceiling Plan for spaces to receive acoustical ceiling tile. Grid shall be laid out and coordinated for lighting fixtures and mechanical system items. Furnish layouts for anchors, clips, and other ceiling anchors whose installation is specified in other Sections.
- D. The installation of the ceiling shall be done prior to the installation of shelving, built-in counters, and finished floors; but after the other work in the room has been completed, including painting, unless otherwise approved by the A/E.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 and design requirements indicated, per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install suspension wires 4 foot on center, maximum in both directions. For lighting fixtures install hanger wires to runners at all 4 corners of fixtures.
 - 2. 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.
 - 3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 4. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 5. 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. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 6. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structures.
 - 7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, that extend through forms into concrete.
 - a. Powder-actuated fasteners are not allowed.
 - 8. 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.
 - 9. Do not attach hangers to steel deck tabs.
 - 10. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 11. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 - 12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications and so deflection does not exceed 1/360 of the span.

- C. Install clouds in accordance with the manufacturer's instructions and in compliance with authorities with jurisdiction.
 - 1. Review the location of the "strongback" carrying channels. Locate 2 foot from longest side of the cloud and 4 foot on center.
 - 2. Hanging cables shall be plumb, located along the length of the "strongback" carrying channel starting 1 foot from the end (2 foot from the edges of the cloud) and then 4 foot on centers (note that in some instances this pattern will result in two hanging cables being positioned 2 foot from one another at the center of the cloud).
 - a. Install supplemental suspension members and hangers in the form of trapeze or equivalent devices as required so as not to splay hangers. Hangers shall be plumb.
 - b. Cables shall be fitted with a loop at one end that is cinched to mounting hardware appropriated for the surface to which it is attached. Select hardware that will be capable of supporting a minimum of 200 lbs.
 - 3. Install mains and tees in accordance with manufacturer's requirements.
 - 4. Install trim as indicated and in accordance with manufacturer's requirements.
 - a. Suspension (perimeter) trim shall be braced 24 inches on center.
- D. Secure bracing wires, if required by authorities, with jurisdiction, 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.
- E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
- F. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- G. 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 a neat, precise fit.
 - 1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 - 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, if edges are not concealed by suspension system flanges.

3.4 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 09 51 13

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient molding accessories.

1.2 ACTION SUBMITTALS

- A. Samples for Initial Selection: For each type of product indicated.

1.3 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Receipt for extra materials.

1.4 MAINTENANCE MATERIALS

- A. Leave, at Project where directed, any remaining full size pieces of each type, color, pattern, and size for Owner's maintenance.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. Maintain the ambient relative humidity between 40 percent and 60 percent during installation.
- C. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 85 deg F.
- D. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: As determined by a qualified testing agency by testing identical products.
 - 1. Critical Radiant Flux Classification (ASTM E 648 or NFPA 253): Class I (not less than 0.45 watts per cm²).
 - 2. Smoke Generation (ASTM E 662 or NFPA 258): Maximum specific optical density of 450 or less.
- B. Accessibility: Transitions and adaptors shall comply with accessibility requirements of the U.S. Architectural and Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 as required by local authorities with jurisdiction.

2.3 RESILIENT BASE (RB)

- A. Resilient Base:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong World Industries, Inc.
 - b. Mannington Mills, Inc.
 - c. Burke Mercer Flooring; Division of Burke Industries, Inc.
 - d. Flexco, Inc.
 - e. Johnsonite; a Tarkett company.
 - f. Musson, R. C. Rubber Co.
 - g. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
 - h. PRF USA, Inc.
 - i. Roppe Corporation, USA.
 - j. VPI, LLC; Floor Products Division.
 - k. Allstate Rubber Corp.
- B. Resilient Base Standard: ASTM F 1861.
 - 1. Material Requirement: Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic).
 - 2. Manufacturing Method: Group I (solid, homogeneous) or Group II (layered).
 - 3. Style and Location: Style B, Cove: Provide unless otherwise noted or required by governing authority.
- C. Minimum Thickness: 0.125 inch.
- D. Height: 4 inches, unless otherwise noted.
- E. Lengths: Cut lengths, 48 inches long.
- F. Outside Corners: Factory preformed or factory precut. Corners must be a minimum of 4 inches in length each way.
- G. Inside Corners: Factory preformed or job formed.
- H. Finish: Satin.
- I. Colors and Patterns: Refer to "List of Finishes".

2.4 RESILIENT MOLDING ACCESSORY (RMA)

- A. Resilient Molding Accessory:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong World Industries, Inc.
 - b. Flexco, Inc.
 - c. Johnsonite; a Tarkett company.
 - d. R.C.A. Rubber Company (The).
 - e. Roppe Corporation, USA.
 - f. Burke Mercer Flooring Products; a division of Burke Industries Inc.
 - g. VPI, LLC; Floor Products Division.
 - h. Musson Rubber Co.
- B. Description: Carpet edge for glue-down applications; Nosing for carpet; Nosing for resilient floor covering; Reducer strip for resilient floor covering; Joiner for tile and carpet; Transition strips.
- C. Material: Vinyl or rubber, unless otherwise noted.
 - 1. Where indicated, provide extruded aluminum with mill finish of width shown, of height required to protect exposed edges of floor coverings, and in maximum available lengths to minimize running joints.
- D. Profile and Dimensions: As indicated.
 - 1. General, provide where meeting unfinished floor or flooring of different material transitions.
 - a. Comply with accessibility requirements for change in level and slope requirement for ramps.
- E. Colors and Patterns: Refer to "List of Finishes".

2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
- C. Metal Edge Strips, where indicated: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Mechanically remove contamination on the substrate that may cause damage to the resilient material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the material or used to work the substrate as they could bleed through and stain the material.
 - 4. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
 - a. At pH test for alkalinity must be conducted. Results should range between 7 and 9. If the test results are not within the acceptable range of 7 to 9, the installation must not proceed until the problem has been corrected.
 - 5. Moisture Testing: Perform tests recommended by manufacturer at least 60 days in advance of flooring installation to allow sufficient drying time of levels are found to be excessive.
 - a. If moisture levels in concrete slabs are too high, temporary climate control will be used to remove excess moisture to levels acceptable to floor manufacturer. Refer to Division 01 Section "Temporary Facilities and Controls".
 - 6. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 85 percent relative humidity level measurement.
 - 7. Proceed with installation only after unsatisfactory conditions have been corrected.
 - a. Installation of flooring products indicates acceptance of surfaces and conditions.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Floor covering shall not be installed over expansion joints.
- E. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
 - 1. Exception: Resilient base shall not wrap 1 inch thick worksurface supports between workstations.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.

- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 - 1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 4 inches in length.
 - a. Butt one piece to corner then cope/scribe next piece to fit.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid vinyl floor tile.
 - a. Luxury Vinyl Tile (LVT).
- B. Related Sections:
 - 1. Division 03 Section "Cast-in-Place Concrete" for vapor retarder.
 - 2. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Conference: Before resilient tile installation, conduct a conference at Project site to review mock-ups, joint locations, transitions, installation methods, and pattern layouts. A/E will schedule and conduct meeting.
 - 1. Flooring manufacturer shall have a representative at the Preinstallation conference.

1.3 ACTION SUBMITTALS

- A. Samples for Verification: Full-size units of each color and pattern of floor tile required.

1.4 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For each type of floor tile to include in maintenance manuals.
 - 2. Receipt for extra materials.

1.5 MAINTENANCE 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. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Flooring product manufacturer will have a technical installation representative available at the job site at the inception of the installation to insure there are no conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer's technical representative will document and confirm that the substrate, material, and installation are in compliance with manufacturer's guidelines and accepted industry standards and practices.
 - 1. Any noticed defect with the product or installation system will require the response of the manufacturer's technical field service personnel on site to determine cause, correction or replacement.
- B. Installer's Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation method.

- C. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockups for floor tile including accessories.
 - a. Size: First-in-place 100 sq. ft. for each type, color, and pattern shall serve as mockup.
 - 1) Perform bond testing on mockup.
 - 2. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockups, unless A/E 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
 - 1. 48 hours (minimum) before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. Maintain the ambient relative humidity between 40 and 60 percent during installation.
- C. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- D. Close spaces to traffic during floor tile installation.
- E. Close spaces to traffic for 48 hours after floor tile installation.
- F. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide product by the manufacturers specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
 - 1. Where products are indicated on List of Finishes with colors selected, provide sample to verify color match with substitution request.

- C. Source Limitations: Obtain resilient tile flooring of same standard, class and type from one manufacturing plant to minimize size variations. Flooring from one manufacturer but separate plants is not acceptable.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: As determined by a qualified testing agency by testing identical products.
 - 1. Critical Radiant Flux Classification (ASTM E 648 or NFPA 253): Class I (not less than 0.45 watts per cm²).
 - 2. Smoke Generation (ASTM E 662 or NFPA 258): Maximum specific optical density of 450 or less.
- B. Accessibility: Flooring shall comply with accessibility requirements of the U.S. Architectural and Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 as required by local authorities with jurisdiction.
 - 1. Comply with ASTM D 2047, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring: Exceeds Federal Standards and ADA requirements for slip-resistance.

2.3 SOLID VINYL FLOOR TILE (SVT)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified in "List of Finishes":
 - 1. Luxury Vinyl Tile (LVT):
 - a. Composite construction built with a solid homogeneous calendared layers reinforced with non-woven glass fiber combined with a polymeric base and heavy commercial wearlayer.
- B. Tile Standard: ASTM F 1700.
 - 1. Class: Class I monolithic vinyl tile and Class III, printed film vinyl tile.
 - 2. Type: Type A, smooth surface and Type B, embossed surface.
- C. Thickness: 6.0 mm
 - 1. Wear Layer: 28 mil, where indicated by product in "List of Finishes".
- D. Applied Finish: Manufacturer's, factory-applied, permanent, UV-cured.
 - 1. Polyurethane surface treatment.
- E. Size: As indicated in "List of Finishes".
- F. Seaming Method: Standard.
- G. Colors and Patterns: As indicated in "List of Finishes".

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated and coordinate with substrate. Note: A primer may be required.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
 - 1. Coverage: Full-surface application
 - 2. Adhesives shall be approved by manufacturer for use over concrete substrates with maximum RH of 95 percent (ASTM F2170) and maximum pH of 9.
 - 3. If Resilient Tile Flooring manufacturer does not have moisture/water resistant adhesive for the relative humidity values, provide adhesives as specified in Division 09 Section "Moisture Resistant/Water-Proof Flooring Adhesive for Concrete Slabs".

2.5 SOURCE QUALITY CONTROL

- A. Manufacturer Services: Manufacturer assures the product submitted is appropriate for the application and environment in which it is to be installed and that the product is merchantable for service, free of visible and latent defects and will perform for the purpose for which it is intended without compromise.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, curing compounds, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected and manufacturer has approved substrate for material to be installed without compromise.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
 - 1. Bond Test: An adhesive bond test must be performed using the actual flooring materials and adhesive to be installed. The tests area must be a minimum of 36 by 36 inches and remain in place for at least 72 hours and then evaluated for bond strength to the substrate.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - a. Mechanically remove contamination of the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - a. A pH test for alkalinity must be conducted. Results should range between 7 and 9. If the test results are not within the acceptable range of 7 to 9, the installation must not proceed until the problem has been corrected.
 - 4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, unless otherwise noted in manufacturers printed literature.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 85 percent relative humidity level measurement.
 - c. Moisture testing shall be performed at least 60 days in advance of flooring installation to allow sufficient drying time for levels acceptable to floor manufacturer.

- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
 - 1. Underlayment shall be steel troweled smooth and trowel marks showing through installed tile shall be reason to remove the tile and sand out trowel marks.
 - 2. Provide skim coat of trowelable leveling and patching compound over entire surface scheduled to receive resilient tile flooring.
- D. Floor covering shall not be installed over expansion joints.
- E. Do not install floor tiles until they are same temperature as space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using manufacturer recommended method for materials and substrate indicated. Produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
 - 1. Tiles should be lightly butted together when placing the flooring into adhesive.
 - 2. Do not force tiles together creating a ledge condition at the seams and corners. Sliding tiles will result in forcing the adhesive out between the seams.
 - 3. Periodically, lift the corner of an installed tile to ensure proper transfer of adhesive.
 - 4. Roll floor in both directions with a 100 pound three-section roller. Use a small hand roller in areas that cannot be reached with a large roller.
 - 5. Roll the flooring in both directions using a 100 pound three-section roller.

6. Inspect the floor surface, especially seams, and remove any adhesive on the surface.
7. Install adhesive as recommended for the site conditions and follow adhesive label for proper use.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 1. Remove adhesive and other blemishes from exposed surfaces.
 2. Sweep and vacuum surfaces thoroughly.
 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
 1. No traffic for 24 hours after installation.
 2. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.
- D. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 68 13 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes modular carpet tile.
- B. Related Sections include the following:
 - 1. Division 09 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.
 - 2. Division 12 Section "Entrance Carpet Tile" for entrance carpet tiles.

1.2 REFERENCES

- A. Carpet and Rug Institute:
 - 1. The Carpet Primer
 - 2. Carpet Installation Standard
- B. ASTM Standards:
 - 1. ASTM F-1869 – Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Calcium Chloride.
 - 2. ASTM F-710 – Standard Practice for Preparing Concrete to Receive Resilient Flooring.
 - 3. ASTM F-2170 – In-situ Relative Humidity Testing.

1.3 DEFINITIONS

- A. Carpet Terminology: Refer to Carpet and Rug Institute (CRI) – "Carpet Installation Standard, Appendix."

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct meeting 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.
 - 2. Flooring product manufacturer will have a technical installation representative available at the jobsite at the inception of the installation to insure there are no conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer's technical representative will document and confirm that the substrate, material and installation are in compliance with manufacturer's guidelines and accepted industry standards and practices.

1.5 ACTION SUBMITTALS

- A. 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.

1.6 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

- a. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - b. Precautions for cleaning materials and methods that could be detrimental to carpet tile.
- 2. Warranty: Special warranty specified in this Section.
- 3. Receipt for extra materials.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.8 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Carpet tile product manufacturer will have a technical installation representative available at the job site at the inception of the installation to insure there are not conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer's technical representative will document and confirm that the substrate, material, and installation are in compliance with manufacturer's guidelines and accepted industry standards and practices.
 - 1. Any noticed defect with the product or installation system will require the response of the manufacturer's technical field service personnel on-site to determine cause, correction or replacement.
- B. Mockups: Build mockups to verify selections to demonstrate aesthetic effects, and to set quality standards for installation method including orientation of the carpet tile.
 - 1. First-in-Place: 100 sq.ft. shall serve as mockup.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104, Section 5, "Storage and Handling."
 - 1. Storage: Store carpet and related materials in a climate-controlled, dry space. Protect carpet from soil, dust, moisture and other contaminants and store on a flat surface.
- B. Carpet shall be delivered to the jobsite in the original mill wrappings with each roll having its size, dye lot, material, and register number properly marked on each bale. When delivered to the jobsite, deliver register number tags to the A/E along with a sample of each carpet cut from the roll.

1.10 FIELD CONDITIONS

- A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."
- B. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- 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.

1.11 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, excess static discharge, and delamination.
 - 3. Warranty Period: Manufacturer's standard for selected product, at least a minimum 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.
 - 1. Refer to "List of Finishes."
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
 - 1. Where products are indicated on List of Finishes with colors selected, provide sample to verify color match with substitution request.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated, as determined by testing identical products per ASTM E 648 and NFPA 253 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux Classification: Not less than 0.45 W/sq.cm.
 - 2. Flooring Radiant Panel Test: Meets NFPA Class 1 when tested under ASTM E-648 glue down.
 - 3. Smoke Density: NBS Smoke Chamber NFPA-258, less than 450 flaming mode.
- B. Accessibility: Flooring shall be provided to comply with accessibility requirements of the U.S. Architectural and Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 as required by local authorities with jurisdiction.

2.3 CARPET TILE (CART)

- A. General: Refer to "List of Finishes".

2.4 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer. Material must be compatible and coordinated with concrete slab mix.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and high-moisture subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
 - 1. Adhesives shall be approved by manufacturer for use over concrete substrates with maximum RH of 95 percent (ASTM F2170) and maximum pH of 9.

- C. Metal Edge/Transition Strips: Extended aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

2.5 SOURCE QUALITY CONTROL

- A. Manufacturer Services: Manufacturer assures product submitted is appropriate for application and environment in which it is to be installed and that product is merchantable for service, free of visible and latent defects and will perform for purpose for which it is intended without compromise.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
 - a. Acceptable moisture emission rate of 3-lbs./1000 sq.ft. per 24 hours or less according to an anhydrous calcium chloride test, (ASTM F 1869) unless otherwise noted.
 - b. Moisture testing shall be performed at least 60 days in advance of flooring installation to allow sufficient drying time if levels are found to be excessive.
 - 2. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 85 percent relative humidity level measurement.
 - 3. Substrate shall exhibit a pH in range of 5 to 9 when wetted with potable water and tested by applying test paper. Basis-of-Design: pHydron by Micro Essential Laboratory Inc., Brooklyn, NY.
 - 4. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
 - 5. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- D. Proceed with installation only after unsatisfactory conditions have been corrected and manufacturer has approved substrate for material to be installed without compromise.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
 - 1. Bond Test on existing substrates: An adhesive bond test must be performed using the actual flooring materials and adhesive to be installed. The test area must be a minimum of 36 by 36 inches and remain in place for at least 72 hours and then evaluated for bond strength to the substrate.
- 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 wide or wider and protrusions more than 1/32 inch, 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 carpet tile manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
 - 1. During installation, maintain air circulation by operating HVAC system at full capacity.
 - 2. Continue operating ventilation system at normal room temperature for up to 72 hours after installation.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive, in accordance with recommended written installation instructions by manufacturer.
 - 1. Product as installed to be securely attached to floor in compliance with Americans with Disabilities Act (ADA), Section 4.5.3.
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
 - 1. Joints: Modules in complete installation should be tight, but not compressed. To insure proper spacing when installing modular carpet, measure distance covered by 11 modules (10 joints) installed on floor with no visible gaps, peaks or overlaps. Continually check that modules are being installed in compliance with manufacturer specifications for that particular product. Take care not to trap yarn between modules.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 84 33.00 – SOUND-ABSORBING WALL UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Back-mounted acoustical wall panels as indicated.
 - 1. Polyester Felt Acoustical Panels

1.2 DEFINITIONS

- A. NRC: Noise reduction coefficient.
- B. SAA: Sound Absorption Average.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of fabric facing, panel edge, core material, and mounting indicated, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation method.
 - 4. Independent testing agency test reports.
- B. Shop Drawings: For unit assembly and installation.
 - 1. Include plans, elevations, sections, and mounting devices and details.
 - 2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
 - 3. Include details of cutouts and penetrations for other work.
 - 4. Include direction of fabric weave and pattern matching.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors, textures, and patterns available for facing materials for each type of acoustical wall panel indicated. Include samples of installation devices and accessories.

1.4 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For acoustical wall panels and facings to include in maintenance manuals specified in Division 1.
 - 2. Warranties: Special warranties specified in this Section.
 - 3. Receipt of extra materials.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials, fabrication, and installation.
 - 1. First-in-place three wall panels shall serve as mockup.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless A/E 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect acoustical wall treatment from excessive moisture in shipment, storage, and handling. Deliver in unopened bundles and store in a temperature-controlled dry place with adequate air circulation. Do not deliver material to building until wet work, such as concrete and plaster, has been completed and cured to a condition of equilibrium.
- B. Store products in manufacturer's unopened packaging until ready for installation.
 - 1. Store materials flat, in dry, well ventilated space.
 - 2. Do not stand panels on end.
 - 3. Protect edges from damage.

1.7 FIELD CONDITIONS

- A. Environmental Conditions: Do not begin installation until spaces for acoustical wall treatment have been enclosed and maintained at approximately the same humidity and temperature conditions as planned for occupancy. Maintain temperature and humidity as recommended by panel manufacturer.
- B. Field Measurements: Check actual wall surfaces by accurate field measurements before fabrication and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.
- C. Air Quality Limitations: Protect acoustical wall panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

1.8 WARRANTY

- A. Special Warranty: Written warranty, signed by manufacturer agreeing to repair or replace components of acoustical wall panel system that fail in performance, materials, or workmanship within specified warranty period. Failure in performance includes, but is not limited to, acoustical performance. Failure in materials includes, but is not limited to, sagging or distortion of facing or warping of core and acoustical performance.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Polyester Felt Acoustical Panels, Manufacturers: Subject to compliance with requirements, provide product by the manufacturers specified.
 - a. MDC Interior Solutions, Zintra Wall Tile, "Geometrics"
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Provide one of the products indicated for each designation in the Acoustical Wall Panel Schedule at the end of Part 3.

2.2 PERFORMANCE REQUIREMENTS

- A. Acoustical Absorption: Perform testing in accordance with ASTM C423, Type A mounting method unless otherwise specified.
- B. Fire-Test-Response Characteristics: Provide acoustical wall panels with the following surface burning characteristics as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify acoustical wall panels with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: As determined by testing per ASTM E 84:
 - a. Flame Spread: 25 or less.
 - b. Smoke Developed: 450 or less.
 - 2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265.

2.3 MATERIALS, GENERAL

- A. Core Materials:
 - 1. Polyethylene Terephthalate (PET) Felt, 100%.
- B. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit, and as follows:
 - 1. Adhesive.
 - a. As recommended by sound-absorbing wall unit manufacturer.

2.4 FABRICATION

- A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.
 - 1. Sound-Absorption Performance: Provide acoustical wall panels with minimum NRCs indicated, as determined by testing per ASTM C 423 for mounting type specified.
- B. Dimensional Tolerances of Finished Units: Plus, or minus 1/16 inch for the following:
 - 1. Thickness.
 - 2. Edge straightness.
 - 3. Overall length and width.
 - 4. Squareness from corner to corner.
 - 5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Install acoustical wall panels in locations indicated with vertical surfaces and edge plumb, top edges level and in alignment with other panels, scribed to fit adjoining work accurately at borders and at penetrations. Comply with panel manufacturer's printed instructions for installation of panels using type of mounting accessories indicated or, if none indicated, as recommended by manufacturer for substrate.
 - 1. Adhesive Mounting: Size back of panels at 18 inch on center in both directions with thin coating of adhesive in 4-inch squares. Center adhesive dabs the size of a large egg on each sized area, and press panel firmly against substrate, flattening adhesive.

- B. Align and level fabric pattern and grain among adjacent panels.
- C. Construction Tolerances as follows:
 - 1. Variation from Plumb and Level: Plus, or minus 1/16 inch.
 - 2. Variation from Joints from Hairline: Not more than 1/16 inch.

3.3 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.
- C. Remove surplus materials, rubbish, and debris resulting from acoustical wall panel installation, on completion of the Work, and leave areas of installation in a neat and clean condition.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure acoustical wall panels are without damage or deterioration at time of Substantial Completion.
- B. Replace panels that cannot be cleaned and repaired, in a manner approved by A/E before time of Substantial Completion.

3.5 ACOUSTICAL WALL PANEL SCHEDULE

- A. Polyester Felt Acoustical Panel (AWT-_-): Manufacturer's standard panel construction consisting of PET felt with integral color.
 - 1. Panel Shape: As indicated on Drawings and List of Finishes.
 - 2. Thickness: As indicated on Drawings and List of Finishes.
 - 3. Edges: Machined, exposed and folded felt.
 - 4. Corners: Square machined, exposed and folded felt.
 - 5. Color: Refer to List of Finishes.
 - 6. Pattern: Refer to List of Finishes.
 - 7. Mounting: Adhesive.

END OF SECTION 09 84 33.00

SECTION 09 84 36 - SOUND-ABSORBING CEILING UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes shop-fabricated, panel units tested for acoustical performance, including:
 - 1. Sound-absorbing baffle panels.
- B. Related Requirements:
 - 1. Division 09 Section "Acoustical Panel Ceilings": For ceiling grid.
 - 2. Division 09 Section "Sound-Absorbing Wall Units" for shop-fabricated fabric-wrapped wall panels tested for acoustical performance and for coordinated requirements for fabric.

1.2 DEFINITIONS

- A. NRC: Noise reduction coefficient.
- B. SAA: Sound absorption average.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Meeting: Conduct meeting at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, specified.
 - 1. Include construction details, mounting, material descriptions, dimensions of individual components and profiles, and finishes for ceiling units specified.
 - 2. Include furnished specialties and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and mounting devices and details.
 - 2. Include details at joints and corners; and details at ceiling intersections and intersections with walls. Indicate panel edge and core materials.
 - 3. Include reflected ceiling plans showing panel sizes and direction of fabric weave and pattern matching.
- C. Samples for Initial Selection: For each type of finish from ceiling unit manufacturers full range.

1.5 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For sound-absorbing ceiling units to include in maintenance manuals. Include fabric manufacturer's written cleaning and stain-removal recommendations.
 - 2. Sample Warranty: For special warranty.

1.6 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials, fabrication, and installation.
 - 1. Build mockup of typical ceiling area as directed by A/E. Include intersection of wall and ceiling, corners, and perimeters.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless A/E specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and sound-absorbing ceiling unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
 - 1. Environmental conditions required for storage are the same as for installation.
- B. Deliver materials and units in unopened bundles, undamaged containers with identification labels intact and store in a temperature-controlled dry place with adequate air circulation.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install ceiling units until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install sound-absorbing ceiling units until a permanent level of lighting is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect sound-absorbing ceiling units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify locations of ceiling units and actual dimensions of openings and penetrations by field measurements before fabrication.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of ceiling units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Acoustical performance.
 - b. Fabric sagging, distorting, or releasing from panel edge.
 - c. Warping of core.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Polyester Felt Acoustical Blades/Baffles, Manufacturers: Subject to compliance with requirements, provide product by the manufacturers specified.
 - 1. Golterman & Sabo, Inc.
 - 2. MDC Interior Solutions
 - 3. Turf
 - 4. Soelberg Industries
 - 5. Sound Seal
 - 6. Armstrong
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Provide sound-absorbing ceiling units meeting the following requirements as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265.

2.3 POLYESTER FELT ACOUSTICAL BLADES/BAFFLES

- A. Core Materials:
 - 1. Polyethylene Terephthalate (PET) Felt, 100%.
 - 2. Color: Refer to List of Finishes.
- B. Shape: Rectangular blade/baffle
 - 1. Edge: Machined, folded felt, square.
 - 2. Corners: Square, folded felt.
- C. Size and Thickness: 2.25 inches wide.
 - 1. Length and height as indicated on Drawings or List of Finishes.
- D. Suspension: Cable hung to existing gypsum board and wood truss structure above.
 - 1. Components: Manufacturer's standard hardware including but not limited to cable coupler, embedded cable grippers, aircraft cable, and grid clip or as required based on existing conditions and substrates.
 - 2. Provide number of mounting points as required by overall length of components.

2.4 FABRICATION

- A. General: Use manufacturer's standard construction except as otherwise indicated, with facing material applied to face, edges, and back border of dimensionally stable core and with rigid edges to reinforce panel perimeter against warpage and damage.
- B. Measure each area and establish layout of panels and joints of within a given area.
- C. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:
 - 1. Thickness.
 - 2. Edge straightness.
 - 3. Overall length and width.
 - 4. Squareness from corner to corner.
 - 5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Verification of Conditions: Verify that substrate or supporting structure, which has been previously installed under other sections, is acceptable for product installation in accordance with manufacturer's instructions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with sound-absorbing ceiling unit manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.
 - 1. Compliance: Comply with manufacturer's product data, including product technical bulleting, product catalog installation instructions and product carton instructions for installation.
- B. Install sound-absorbing ceiling units in locations indicated with edges in alignment with walls and other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

3.3 INSTALLATION TOLERANCES

- A. Variation from Alignment with Surfaces: Plus or minus 1/16 inch.
- B. Variation from Level or Slope: Plus or minus 1/16 inch.
- C. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.
 - 1. Replace panels that cannot be cleaned to as new condition.

3.5 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure acoustical ceiling panels are without damage or deterioration at time of Substantial Completion.
- B. Replace panels that cannot be cleaned and repaired, in a manner approved by A/E, before time of Substantial Completion.

END OF SECTION 09 84 36

SECTION 09 91 23.00 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and application of paint systems on the following interior substrates:
 - 1. Steel and iron.
 - 2. Galvanized metal.
 - 3. Gypsum board.
 - 4. Cotton or canvas insulation covering.
 - 5. ASJ insulation covering.
- B. Work under this contract shall also include, but not necessarily be limited to following:
 - 1. Surface preparation of substrates as required for acceptance of painting, including cleaning, small crack repair, patching, caulking, and making good surfaces and areas to limits defined under Master Painters Institute (MPI) preparation requirements.
 - a. Preparation and testing of existing painted surfaces, indicated to be repainted to accommodate new work, shall be performed as work of this Section.
 - b. Specific pre-treatments noted herein or specified in MPI Repainting Manual.
 - c. Sealing/priming surfaces for repainting in accordance with MPI Repainting Manual requirements.
 - 1) When re-painting existing surfaces, "making good surfaces" includes removal of adhesive tape, hanging devices, nails, screws, and similar items, and repair of associated surface defects to match adjoining surface.
 - d. Provide for safe and adequate ventilation as required over and above temporary ventilation supplied by others, where toxic and/or volatile/flammable materials are being used.
 - 2. Surface preparation and prime painting surfaces for wall coverings prior to installation in accordance with MPI and wall covering manufacturer's requirements.
 - 3. Priming (except where pre-primed with an approved primer under other sections of work) and painting of structural steel, miscellaneous metal, ornamental metal and primed steel equipment.
 - 4. Priming and back-priming of wood materials as noted herein or specified in MPI Architectural Painting Specification Manual.
 - 5. Painting of all semi-concealed areas (e.g. inside of light troughs and valances, behind grilles, and projecting edges above and below sight lines).
 - 6. Painting of exposed-to-view fire suppression, plumbing, HVAC, electrical, communication, and electronic safety and security.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Prefinished items include following factory finished components:
 - 2. Concealed surfaces including walls or ceilings in following generally inaccessible spaces:
 - a. Foundation spaces
 - b. Furred areas
 - c. Ceiling plenums
 - d. Utility tunnels
 - e. Pipe spaces
 - f. Duct shafts, unless otherwise noted
 - g. Elevator shafts
 - 3. Finished metal surfaces include following:
 - a. Anodized aluminum
 - b. Stainless steel
 - c. Chromium plate
 - d. Copper and copper alloys
 - e. Bronze and brass

4. Operating parts include moving parts of operating equipment.
 - a. Valve and damper operators (including valve stems).
 - b. Linkages
 - c. Sensing devices
 - d. Motor and fan shafts
5. Labels: Do not paint over UL, FMG, or other code required labels or equipment name, identification, performance rating, or nomenclature plates.
6. Communication Cable: Do not paint cable and protect communications cabling from overspray. Paint voids warranty of cable and if painted shall be replaced at painting contractors expense.
 - a. Communications plenum cable.
 - b. Communications riser cable.
 - c. Communications general purpose cable.
 - d. Communications cable, limited use.
 - e. Under carpet communications wire and cable.

D. Related Sections include following:

1. Division 05 Sections for shop priming of metal substrates.
2. Division 09 Section "Gypsum Board Assemblies" for texture finishes and repairs.
3. Division 09 Section "High Performance Coatings" for special finishes.

1.2 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter. (MPI values similar to G1 and G2).
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter. (MPI values similar to G3 and G4).
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter. (MPI values similar to G5).
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter. (MPI values similar to G6 and G7).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for application and use.

1. Provide paint system summary prepared by Manufacturer listing paint systems for each applicable material to be painted.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.4 CLOSEOUT SUBMITTALS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:

1. Receipt of extra materials. Properly package materials and obtain a signed receipt.
2. At Project completion provide an itemized list complete with manufacturer, paint type and color coding of all paints used for Owner's later use in maintenance.

1.5 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List," unless otherwise noted.
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
 - a. All surface requiring repainting shall be inspected by painting subcontractor who shall notify A/E, CM, and General Contractor in writing of any defects or problems, prior to commencing repainting or after preparation work.
 - b. Where "special" coatings or decorative systems (i.e. textured coatings or non-MPI listed products or systems) are to be used, paint manufacturer shall provide as part of this Work, certification of all surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Owner.

B. Regulatory Requirements

1. Conform to work place safety regulations for storage, mixing, application and disposal of all paint related materials to requirements of those authorities having jurisdiction.
2. To reduce amount of contaminants entering waterways, sanitary/storm drain systems or into ground following procedures shall be strictly adhered to:
 - a. Retain cleaning water for water-based materials to allow sediments.
 - b. Retain cleaners, thinners, solvents, and excess paint and place in designated containers and ensure proper disposal.
 - c. Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - d. Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
 - e. Empty paint cans are to be dry prior to disposal or recycling.
 - f. Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

C. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Surface-Preparation Mockups: On existing surfaces using applicable methods recommended in MPI's Maintenance Repainting Manual and paint manufacturer demonstrate methods of cleaning and other surface preparation, where indicated by A/E. Provide mockup sample of at least 100 sq.ft. for each type of wall substrate.
2. A/E will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Wall and ceiling surfaces, unless otherwise noted, first-in-place 100 sq.ft. of each product and surface may serve as mockup.
 - 1) Provide a test patch where deep colors are indicated.
 - b. Other Items: A/E will designate items or areas required.
3. Apply benchmark samples after permanent lighting and other environmental services have been activated.
4. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by A/E at no added cost to Owner.
5. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless A/E specifically approves such deviations in writing.
6. Subject to compliance with requirements, approved mockups may become part of completed work if undisturbed at time of Substantial Completion.

- D. Preinstallation Meeting: Conduct meeting at Project site.
 - 1. Review methods and procedures related to painting, but not limited to, following:
 - a. Construction Schedule. Verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Materials, material application, colors, patterns, and sequencing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to job site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. VOC content.
- B. Store Materials
 - 1. Store only approved materials at jobsite and store only in a suitable and designated area restricted to storage of paint materials and related equipment.
 - a. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - b. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.
 - c. Remove rags and waste from storage areas daily.
 - 2. Use means necessary to ensure safe storage and use of paint materials and prompt and safe disposal of waste.
 - 3. Use means necessary to protect paint materials before, during, and after application and to protect installed work and materials of other trades.
 - 4. Where toxic and/or volatile/explosive/flammable materials are being used, provide adequate fireproof storage lockers and take all necessary precautions and post adequate warnings as required.
 - 5. Take all necessary precautionary and safety measures to prevent fire hazards and spontaneous combustion and to protect environment from hazard spills. Materials that constitute a fire hazard (paints, solvents, drop clothes, etc.) shall be stored in suitable closed and rated containers and removed from site on a daily basis.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
 - 1. Apply solvent thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F. and 95 degrees F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above dew point; or to damp or wet surfaces.
- C. Perform no interior painting or decorating work unless adequate continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above minimum requirements for 24 hours before, during, and after paint application. Provide supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
- D. Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect quality of finished surfaces.

- E. Perform no painting or decorating work unless a minimum lighting level of 30 foot candles is provided on surfaces to be painted.

1.8 SCHEDULING

- A. Schedule painting operations to prevent disruption of and by other trades.
- B. Schedule painting operations in occupied facilities to prevent disruption of occupants in and about building. Paint shall be carried out after facility working hours or on weekends in accordance with Owner's operating requirements. Schedule work such that painted surfaces will have dried before occupants are affected. Obtain written authorization from CM or Owner for changes in work schedule.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied in unopened cans and that are packaged for storage and identified with labels describing contents for Owner's later use in maintenance. Store where directed.
 - 1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers on current "MPI Approved Products List".
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility: Paint materials selected for coating systems for each type of surface shall be product of a single manufacturer.
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. Paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with surface to be coated; tools and equipment shall be compatible with coating to be applied.
 - 1. Review other Sections in which primers are provided to ensure compatibility of total system for various substrates. On request, furnish information on characteristic of finish materials to ensure use of compatible primers.
- D. Thinners, when used, shall be only those thinners recommended for that purpose by manufacturer of material to be thinned.
- E. All materials used shall be lead- and mercury-free and VOC-compliant with local authorities with jurisdiction.

- F. Colors: As indicated in "List of Finishes."
- G. By submitting a proposal, Contractor has reviewed bidding documents with painting subcontractor and accepts Specifications as sufficient to produce approved painting results. If painting subcontractor contends that materials or number of coats specified will not produce satisfactory results, he shall so notify A/E directly or indirectly through a Bidding Contractor 10 days prior to receipt of bids for proper action.

2.3 MIXING AND TINTING

- A. Unless otherwise specified or pre-approved, all paints shall be ready mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity.
- B. Paste, powder, or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- C. Where thinner is used, addition shall not exceed paint manufacturer's recommendations.
- D. If required, thin paint for spraying in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to A/E.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Test suspect surfaces (concrete, masonry, plaster and wood surfaces) for moisture and alkalinity as required by paint manufacturer. Conduct all moisture tests using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a "cover patch test, unless otherwise required by paint manufacturer. Maximum moisture shall not exceed:
 - 1. 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.
 - 1. Test galvanized surfaces for chromates or other passivating treatments.
- E. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
 - 1. Proper product selection, surface preparation and application affect coating performance. Coating integrity and service life will be reduced because of improperly prepared surfaces. Selection and implementation of proper surface preparation ensures coating adhesion to substrate and prolongs service life of coating system.

- B. Remove and securely store all miscellaneous hardware and surface fittings/fastenings (e.g. electrical plates, mechanical louvers, door and window hardware) (e.g. hinges, knobs, locks, trim frame stops), removable rating/hazard/instruction labels, washroom accessories, light fixture trim, etc. from wall and ceiling surfaces, door and frames, prior to repainting and replace upon completion. Carefully clean and replace all such items upon completion of repainting work in each area. Do not use solvent or reactive cleaning agents on items that will mar or remove finishes (e.g. lacquer finishes). Doors shall be removed before repainting to paint bottom and top edges and then re-hung. 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 trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Protect all adjacent interior surfaces and areas, including rating and instruction labels on doors, frames, equipment, piping, etc., from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.
1. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, nomenclature plates, or communicating cabling.
- D. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
1. Schedule cleaning and painting application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.
 2. Remove incompatible primers and reprime substrate with compatible primers or provide barrier coats as required to produce paint systems indicated. Notify A/E in writing about anticipated problems using specified finish coats materials with substrates primed by others.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than following:
1. SSPC-SP 2, "Hand Tool Cleaning."
 2. SSPC-SP 3, "Power Tool Cleaning."
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
1. Surface preparation should start with SSPC SP-1 Solvent Cleaning to remove oil/grease contamination. If galvanized surface is shinney, surface must be de-glossed and roughened in one of two ways:
 - a. In mild building environments, wash with a chemical etching solution such as MPI #25.
 2. Galvanized metals are very smooth and have virtually no profile for coating to adhere to. It is important to abrade surface of galvanized metal through Brush of Blast (SSPC SP7), or an etching primer before coatings application, as recommended by paint manufacturer.
 3. Galvanized surfaces must use a primer before applying a topcoat. Topcoats will not adhere to zinc layer of galvanized surface and requires a primer to form a bond between two. Manufacturer's water-based bonding primers as an alternative to previously used cementitious primers. An epoxy primer may also be used, however, it should be noted that epoxy primers typically require an abrasive blast-cleaned surface.
- H. Gypsum Wallboard: Must be clean and dry. Fill nail heads must be set and spackled. Joints must be taped and covered with joint compound. Spackled nail heads and taped joints must be sanded smooth and all dust removed prior to painting.
1. Vacuum wall with brush attachment.
 - a. As wall is vacuumed, wipe if down with microfiber cloth. Piles of dust may accumulate near base. Be sure to vacuum this dust before you begin to paint; otherwise, it could become airborne and ruin your smoothly painted wall.

2. Wipe down wall with microfiber cloth.
 3. Gently wash walls.
 - a. Apply water sparingly. Let wall dry thoroughly before painting.
 4. Repeat steps until all traces of dust are removed.
- I. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. General: Do not commence painting unless substrates are acceptable and until all environmental conditions (heating, ventilation, lighting and completion of other substrate work, if applicable) are acceptable for applications of products.
- B. 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. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
 5. Omit first coat (primer) on metal surfaces that have been shop primed and touch-up painted, unless otherwise indicated.
 6. Where a level 5 drywall finish is specified or required in critical lighting conditions or when using non-flat finish, comply with following to optimize results:
 - a. Even if initial finish was sprayed, back roll surface: Stipple pattern of roller can help hide underlying texture variations. A 1/2 inch/15 mm nap roller may offer best and most efficient results.
 - b. When finish occurs in phases (stops one batch and finishes with another) painter shall "blend back" finish of each new section by shading new topcoat back over previous section with a spray gun; with a flat finish, this can effectively prevent a noticeable difference between sections finished at different dates with material from different batches.
- C. Scheduling Painting: Apply first coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of undercoat, unless manufacturer's directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.
 2. Slightly vary color of succeeding coats.
- D. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate.
1. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
 2. Sand and dust between each coat to provide an anchor for next coat and to remove defects in previous coat (runs, sags, etc.) visible from a distance up to 39 inches.
 3. Deep and accent clear base colors may require 1 or 2 more coats to achieve proper hide.
- E. 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.

- F. 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.
 - 1. To avoid air entrapment in applied coats, apply material in strict accordance with manufacturer's spread rates and application requirements.
- G. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication and Electronic Safety and Security Work:
 - 1. Paint following work where exposed in equipment rooms:
 - a. Mechanical, electrical, and other equipment:
 - 1) Exceptions:
 - a) Do not paint electrical switchgear, transformers or substation equipment.
 - b) Do not paint new electrical panelboards.
 - c) Do not paint communication cabling.
 - d) Do not paint sprinkler heads.
 - 2) Touch up scratches and marks and repaint such mechanical and electrical equipment and components with color, and sheen finish to match existing, unless otherwise noted or scheduled.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - 2. Paint following work where exposed in occupied spaces:
 - a. Mechanical, electrical, and other equipment:
 - 1) Exceptions:
 - a) Do not paint electrical switchgear, transformers or substation equipment.
 - b) Do not paint new electrical panelboards.
 - c) Do not paint communication cabling.
 - d) Do not paint sprinkler heads.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - 3. Paint portions of internal surfaces of metal ducts, without liner behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves right to invoke following procedure at any time and as often as Owner deems necessary during period when paints are being applied:
 - 1. Owner will engage services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance with product requirements, including dry film thicknesses.
 - a. Contractor shall touch up and restore painted surfaces damaged by testing.
 - b. 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. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, two paints are incompatible.

B. Standard of Acceptance

1. All surfaces, preparation and paint applications shall be inspected by A/E.
2. Painted interior surfaces shall be considered to lack uniformity and soundness if any of following defects are apparent to A/E:
 - a. Brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
 - b. Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
 - c. Damage due to touching before paint is sufficiently dry or any other contributory cause.
 - d. Damage due to application on moist surfaces or caused by inadequate protection from weather.
 - e. Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).
3. Painted surfaces shall be considered unacceptable if any of following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
 - a. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
 - b. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
 - c. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
 - d. When final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
4. Painted surfaces rejected by A/E shall be made good at expense of Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 1. Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.
 2. Clean equipment and dispose of wash water/solvents as well as all other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers/strippers in accordance with safety requirements of authorities having jurisdiction.
- 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 A/E, and leave in an undamaged condition.
 1. Erect barriers or screens and post signs to warn, limit or direct traffic away or around work area as required.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE (P-CODE)

A. Steel (Ferrous) Substrates:

1. Institutional Low-Odor/VOC Latex System: (Code #5.12)
 - a. Prime Coat: Rust-inhibitive primer (water based).
 - 1) Sherwin Williams; Pro Industrial Pro-Cryl Universal Primer
 - 2) PPG: Pitt-Tech Plus EP Acrylic Primer, 90-1912
 - 3) Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
 - 4) Behr Metal Primer No. 435
 - 5) Verify compatibility with primer, if shop-applied primer is used.
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).
 - 1) Sherwin Williams; B66-600 Pro Industrial High Performance Acrylic or Pro Industrial Waterbased Alkyd Urethane, B53-2150 Series.
 - 2) PPG: Pitt-Tech Plus EP DTM Acrylic, 90-1610 Series.
 - 3) Benjamin Moore: Ultra Spec HP DTM Acrylic Enamel – HP25 (Low Luster) HP29 (Semi-Gloss)
 - 4) Application includes, but is not limited to:
 - a) Hollow metal doors, including vision lite kits, frames, door mullions and astragals.
 - b) Access doors.
 - c) Exposed to view, in public areas, fire suppression, plumbing, HVAC, electrical communication, and electronic safety and security unfinished items.

B. Galvanized-Metal Substrates:

1. Institutional Low-Odor/VOC Latex System: (Code #5.32).
 - a. Prime Coat: Waterborne galvanized-metal bonding primer. MPI #134.
 - 1) Sherwin Williams: Pro Industrial Pro-Cryl Universal Primer
 - 2) PPG: Pitt-Tech Plus EP Acrylic Primer, 90-1912.
 - 3) Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
 - 4) Behr Metal Primer No. 435
 - 5) Note: Primer may be omitted, if not required by paint manufacturer.
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).
 - 1) Sherwin Williams: B66-600 Pro Industrial High Performance Acrylic or Pro Industrial Waterbased Alkyd Urethane B53-2150 Series.
 - 2) PPG; Pitt-Tech Plus EP DTM Acrylic, 90-1610 Series.
 - 3) Benjamin Moore: Ultra Spec HP DTM Acrylic Enamel – HP29 (Semi-Gloss) HP-28 (Gloss)
 - 4) Application includes, but is not limited to:
 - a) Other non-ferrous surfaces.

C. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System: (Code #9.21)
 - a. Prime Coat: Interior latex primer/sealer. .
 - 1) Sherwin Williams; Pro Mar 200 Zero VOC Latex Primer
 - 2) PPG; 6-2 Speedhide Quick Drying Latex Sealer
 - 3) Benjamin Moore: Super Spec, 253.
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex flat.
 - 1) Sherwin Williams; Pro Mar 200 Zero VOC
 - 2) PPG; Speedhide Zero, 0 VOC
 - 3) Benjamin Moore: Ultra Spec 500, N539
 - 4) Application includes, but is not limited to:
 - a) Horizontal gypsum surfaces.
2. Institutional Low-Odor/VOC Latex System: (Code #9.22)
 - a. Prime Coat: Interior latex primer/sealer.
 - 1) Sherwin Williams; Pro Mar 200 Zero VOC Latex Primer
 - 2) PPG; 6-2 Speedhide Quick Drying Latex Sealer

- 3) Benjamin Moore: Ultra Spec 500 Interior Zero VOC Latex Primer N534
 - 4) Behr Premium Urethane Alkyd Semi-Gloss Enamel No. 3900
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex eggshell.
 - 1) Sherwin Williams; Pro Mar 200 Zero VOC
 - 2) PPG; Speedhide Zero, 0 VOC
 - 3) Benjamin Moore: Ultra Spec 500 Interior Low Sheen Eggshell T537
 - 4) Behr IPRO Interior Eggshell
 - 5) Application includes, but is not limited to:
 - a) Vertical gypsum surfaces where cleaning is not frequently to occur.
- D. Cotton or Canvas and ASJ Insulation-Covering Substrates:
 - 1. Institutional Low-Odor/VOC Latex System: (Code #10.11)
 - a. Prime Coat: Interior latex primer/sealer.
 - 1) Sherwin Williams; Pro Mar 200 Zero VOC Latex Primer
 - 2) PPG; 6-2 Speedhide Quick Drying Latex Sealer
 - 3) Benjamin Moore: Super Spec, 253.
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).
 - 1) Sherwin Williams; Pro Mar 200 Zero VOC
 - 2) PPG; Speedhide Zero, 0 VOC
 - 3) Benjamin Moore: Ultra Spec 500, N539
 - 4) Application includes, but is not limited to:
 - a) Pipe and duct coverings.

END OF SECTION 09 91 23.00

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and application of high-performance coating systems (HPC) on the following substrates:
 - 1. Exterior Substrates:
 - a. Galvanized metal.
 - 2. Interior Substrates:
 - a. Gypsum board.
- B. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates.
 - 2. Division 09 painting Sections for special-use coatings and general field painting.

1.2 DEFINITIONS

- A. Standard coating terms defined in ASTM D 16 apply to this Section.
- B. Gloss ranges used in this Section include the following:
 - 1. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter. (MPI value similar to G5).
 - 2. High gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter. (MPI values similar to G6 and G7).

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Provide paint system summary prepared by Manufacturer listing paint systems for each applicable material to be painted.
- B. Samples for Verification: For each type of coating system and in each color and gloss of finish coat indicated.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.

1.4 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Receipt of extra materials.

1.5 QUALITY ASSURANCE

- A. Master Painters Institute (MPI) Standards:
 - 1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 - 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and coating systems indicated.
- B. Mockups: Apply benchmark samples 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. A/E will select one surface to represent surfaces and conditions for application of each type of coating and substrate.

- a. Wall and Ceiling Surfaces: Unless otherwise noted, first-in-place 100 sq.ft. of each product and surface may serve as mockup.
 - b. Other Items: A/E will designate items or areas required.
- 2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
- 3. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by A/E at no added cost to Owner.
- 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless A/E 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:
 - 1. Name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. Handling instructions and precautions.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 - 1. Quantity: Furnish an additional 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers on the current "MPI Approved Product List".

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL (HPC)

- A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
 - 3. Provide products of same manufacturer for each coat in a coating system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
 - 1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Gypsum Board: 12 percent.
 - b. Masonry (Clay and CMU): 12 percent.
- B. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- C. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Coating application indicates acceptance of surfaces and conditions.
- E. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.
 - 1. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
 - a. Confirmation of primer's suitability for expected service conditions.
 - b. Confirmation of primer's ability to be top coated with materials specified.
 - 2. Notify A/E about anticipated problems before using the coatings specified over substrates primed by others.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 - 1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

- C. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Schedule cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.
 - 2. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.
- D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA1 for touching up shop-primed surfaces.
- E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.
- F. Gypsum Wallboard: Must be clean and dry. Fill nail heads must be set and spackled. Joints must be taped and covered with joint compound. Spackled nail heads and taped joints must be sanded smooth and all dust removed prior to painting.
 - 1. Vacuum wall with brush attachment.
 - a. As wall is vacuumed, wipe if down with microfiber cloth. Piles of dust may accumulate near base. Be sure to vacuum this dust before you begin to paint; otherwise, it could become airborne and ruin your smoothly painted wall.
 - 2. Wipe down wall with microfiber cloth.
 - 3. Gently wash walls.
 - a. Apply water sparingly. Let wall dry thoroughly before painting.
 - 4. Repeat steps until all traces of dust are removed.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions.
 - 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 back sides 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.

3.4 FIELD QUALITY CONTROL

- A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:
 - 1. Owner will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance with specified requirements.

3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

- B. Dry Film Thickness Testing: Owner reserves the right to engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 1. Contractor shall touch up and restore coated surfaces damaged by testing.
 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing 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 by cleaning, repairing, replacing, and recoating, as approved by A/E, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Galvanized-Metal Substrates:
 1. W.B. Light Industrial Coating System: (Code #5.311).
 - a. Prime Coat:
 - 1) Sherwin Williams: Pro Industrial DTM Acrylic Primer
 - 2) PPG: Pitt-Tech Plus EP Acrylic Primer, 90-1912
 - 3) Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
 - b. Intermediate Coat: W.B. Light Industrial Coating, matching topcoat (semi-gloss).
 - 1) Same as Topcoat
 - c. Topcoat: W.B. Light Industrial Coating, (gloss).
 - 1) Sherwin Williams: Pro Industrial High Performance Acrylic
 - 2) PPG: Pitt-Tech Plus EP DTM Acrylic.
 - 3) Benjamin Moore: Ultra Spec HP DTM Acrylic Semi-Gloss Enamel HP29
 - d. Application includes, but is not limited to:
 - 1) Exposed lintels.
 - 2) Downspout boot assemblies

3.7 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Gypsum Board Substrates:
 1. Water-Based Epoxy Coating System: (Code 9.211).
 - a. Prime Coat: Interior latex primer/sealer.
 - 1) Sherwin Williams; ProMar 200 Zero VOC Interior Latex Primer
 - 2) PPG; 6-2 Speedhide Quick Drying Latex Sealer
 - 3) Benjamin Moore; Ultra Spec 500 Interior Latex Primer N534
 - b. Intermediate Coat: Water-based epoxy (interior and exterior).

- c. Topcoat: Water-based epoxy, semi-gloss (interior and exterior), semi-gloss.
 - 1) Sherwin Williams; Pro Industrial Pre-Catalyzed Epoxy
 - 2) PPG; 16-1510 Pitt-Glaze WB1 Pre-Catalyzed Epoxy
 - 3) Benjamin Moore; Corotech Pre-Catalyzed Waterborne Epoxy V341
- d. Application includes, but is not limited to:
 - 1) High traffic areas where frequent cleaning with detergent and industrial cleaners is likely to occur e.g. toilet room.

END OF SECTION 09 96 00

SECTION 09 96 63 - INTERIOR FINISH SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Surface preparation and interior finish system (IFS) as indicated.
 - 1. Ceiling installation.
- B. Work of This Section; But Specified Elsewhere
 - 1. Division 07 Section "Joint Sealants".
- C. Related Sections:
 - 1. Division 09 Section "Gypsum Board Assemblies": For metal framing.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical information for each component of systems specified.
 - 1. Include technical information, basic materials analysis and instructions for handling, storage, and application.
 - 2. List each coating material and cross reference the specific coating application. Identify each material by manufacturer's catalog number and general classification.
- B. Samples for Initial Color Selection: Manufacturer's color charts.

1.3 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: Methods for maintaining coating and precautions for using cleaning materials and methods that could be detrimental to the finish and performance.
 - 2. Warranty: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Interior Finish System Applicator Qualifications: Applicator shall be approved or certified by the material manufacturer.
 - 1. Installation workmen shall be thoroughly trained and experienced in skills required and shall be completely familiar with manufacturer's current methods of installation as well as requirements of this Work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in original unopened packaging with legible manufacturer's identification.
 - 1. Upon arrival, materials shall be inspected for physical damage, freezing or overheating. Questionable materials shall not be used.
- B. Store products in a cool dry place out of direct sunlight, protected from the elements and from damage.
 - 1. Store at a temperature of not less than 50 degrees F.

1.6 FIELD CONDITIONS

- A. Environmental Requirements
 - 1. Application of the system shall be in ambient temperatures above 50 degrees F. Substrate system shall also be above 50 degrees F.
 - a. For installation in temperatures less than 50 degrees F, supplementary heat shall be provided.

2. A minimum ambient temperature of 50 degrees F shall be maintained for at least 24 hours after the system installation.
 3. Adequate fresh air and ventilation during application shall be provided.
- B. Protection
1. Protect surrounding areas and surfaces to preclude damage during application of the system.
 2. Protect finished Work when stopping for the day or when completing an area in order that water will not penetrate behind the system.
- C. Coordination
1. The Work of this Section requires close coordination between related sections.
 2. Joints to be caulked shall be done immediately after the installation of the system as recommended by manufacturer.
- D. Scheduling: Sufficient manpower and equipment shall be employed to ensure a continuous operation, free of cold joints, scaffold lines, texture variations, etc.

1.7 WARRANTY

- A. Interior Finish System: The complete installation of the system shall be jointly warranted by the installer and the manufacturer against defects in material and workmanship for a period of 5 years following installation and acceptance by the Owner. The warranty shall be submitted in writing through the A/E to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design: StoQuick Finish for Pool Rooms; STO Industries, Inc. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.
1. Firestone, Simplex Products Div.
 2. Parex
 3. Senergy, Inc.
 4. Dryvit Systems, Inc. (Dryvit Architectural Finishes for Indoor Pool Areas)
 5. Omega Products International, Inc.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations: Option interior finish system from single source from single IFS manufacturer and from sources approved by IFS manufacturer as compatible with IFS components.

2.2 SHEATHING

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Sheathing: Provide one of the following, per manufacturers recommendations and system requirements:
1. Glass Mat Gypsum Backing Board: ASTM C 1178.
 - a. Core: 5/8 inch, Type X.

2. Exterior Cement Board: Not less than 7/16 inch, fiber cement board complying with ASTM C1186, Type A, for exterior applications.
 - a. Fasteners: Wafer head or hard-roc steel drill screws complying with ASTM C954, with an organic polymer coating or other corrosion protective coating having a salt-spray resistance of more than 500 hours per ASTM B117.
 - 1) Size and Length: As recommended by sheathing manufacturer for type and thickness of sheathing board to be attached.
3. Tile Backer: ASTM C1179, Type X.
 - a. Core: 5/8 inch, ASTM C36, Type X.

2.3 INTERIOR FINISH SYSTEM - MATERIALS

- A. Job Mix Ingredients
 1. Water: Shall be clear, clean and potable, without any foreign matter in solution which might affect the color or setting qualities of the cement, adhesive, or finish coat; mixed in at factory.
 2. Portland Cement: ASTM C150, Type I.
- B. Reinforcing Mesh: Nominal 4.5 oz./sq. yd., symmetrical, interlaced open weave glass fiber fabric made with minimum 25 percent by weight alkaline resistant coating for compatibility with IFS system manufacturers.
- C. Base Coat: Acrylic based, fiber reinforced, flexible waterproofer.
 1. Basis of Design: Sto Flexyl or Sto Watertight Coat.
- D. Primer: A synthetic resin, pigmented, copolymer based primer. Tint to same shade as finish.
- E. Finish Coat Materials: IFS manufacturer's siliconized acrylic based coating complying with the following requirements for material composition and method of combined materials:
 1. Factory mixed formulation of polymer emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
 2. Texture: Fine sand finish.
 3. Color: As selected by A/E from manufacturer's standards unless otherwise noted in "List of Finishes".
 - a. Multiple colors may be selected.

2.4 ACCESSORIES

- A. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with IFS manufacturer's written requirements; 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 behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
 2. Expansion/Control Joint: Prefabricated one piece V profile; designed to relieve stress of movement.
- B. Elastomeric Sealant Products: Provide IFS manufacturer's listed and recommended chemically curing, elastomeric sealant that is compatible with joint fillers, joint substrates, and other related materials, and complies with requirements for products and testing indicated in EIMA's "EIMA Guide for Use of Sealants with Exterior Insulation and Finish Systems, Class PB" and with requirements in Division 07 Section "Joint Sealants" for products corresponding to description indicated below:
 1. Low modulus, nonacid curing silicone sealant.

2.5 INTERIOR FINISH SYSTEM – MIXING

- A. Materials shall be mixed in clean plastic containers, free of foreign substance. Do not use container which has been used for or cleaned with a petroleum product.
- B. Finish
 - 1. Thoroughly mix the factory prepared finish material with the high speed mixer, until a uniform workable consistency is attained.
 - a. A small amount of clean potable water may be added to adjust workability.
- C. Mix components in strict accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.1 SUBSTRATE INSTALLATION METHODS

- A. Gypsum Board Application and Finish Standards: ASTM C 840.
- B. Apply sheathing panels perpendicular to supports, with end joints staggered and located over supports.
 - 1. Install with 1/4 inch open space where panels abut other construction or structural penetrations.
 - 2. Fasten with corrosion resistant screws.

3.2 INTERIOR FINISH SYSTEM - INSTALLATION

- A. Installation, General: Materials shall be mixed and applied in accordance with manufacturer's published product data sheets for the individual products specified.
 - 1. Under no circumstances shall products be altered by adding any additives, except for small amounts of clean water as directed on the label. Antifreeze, accelerators, rapid binders, etc., are forbidden.
- B. The surface to receive the interior finish system shall be clean and dry. Substrate joints shall be taped and sanded smooth.
- C. Base Coat: Apply to exposed surfaces of insulation in minimum thickness recommended in writing by IFS manufacturer, but not less than 1/16 inch dry coat thickness.
- D. Trim Accessories: Mechanically fasten accessories to framing members, masonry, or concrete at perimeter and control joints.
- E. Reinforcing Mesh: Embed type indicated below in wet base coat to produce wrinkle free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written requirements. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base coat material if necessary, so reinforcing mesh color and pattern are not visible.
 - 1. Standard impact reinforcing mesh.
- F. Primer: Apply over dry base coat according to IFS manufacturer's written instructions.
- G. Finish Coat: Apply over dry primer, maintaining a wet edge at all times for uniform appearance in thickness required by IFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
- H. Provide expansion/control joints at locations specifically recommended by manufacturer and in general conformance with the following:
 - 1. Control joints shall be installed for a maximum of 900 square foot area, or every 30 LF.
 - 2. At expansion or control joints in the substrate.
 - 3. Where IFS system is applied to dissimilar substrates.

3.3 INSTALLATION OF JOINT SEALANTS

- A. Prepare joints and apply sealants, of type and at locations indicated, to comply with applicable requirements in Division 07 Section "Joint Sealants" and in EIMA's "EIMA Guide for Use of Sealants with Exterior Insulation and Finish System, Class PB."
 - 1. Clean surfaces to receive sealants to comply with indicated requirements and IFS manufacturer's written instructions.
 - 2. Apply primer recommended in writing by sealant manufacturer for surfaces to be sealed.
 - 3. Install sealant backing to control depth and configuration of sealant joint and to prevent sealant from adhering to back of joint.
 - 4. Apply masking tape to protect areas adjacent to sealant joints. Remove tape immediately after tooling joints, without disturbing joint seal.

3.4 CLEAN-UP AND PROTECTION

- A. Clean-Up: During progress of Work remove from site discarded coatings materials, rubbish, cans, and rags at end of each work day.
- B. Protection: Protect work of other trades, whether to be coated or not, against damage by coating and finishing work. Correct any damage by cleaning, repairing, or replacing and repainting, as acceptable to A/E.
- C. Provide: "WET PAINT" signs as required to protect newly coated surfaces. Remove temporary protective wrappings and completion of coating operations.
- D. After completion of Work of other trades, touch-up and restore damaged or defaced coated surfaces.

END OF SECTION 09 96 63

10

DIVISION

SPECIALTIES

SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cast dimensional characters.
- B. Related Sections
 - 1. Division 10 Section "Interior Panel Signage", including molded-plastic dimensional letters.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For dimensional letter signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, 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.

1.3 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For signs to include in maintenance manuals.
 - 2. Warranty: For special warranty.

1.4 QUALITY ASSURANCE

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

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers: Subject to compliance with requirements, provide signage by one of the manufacturers specified herein.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" Sample sign, and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 DIMENSIONAL CHARACTERS

- A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
 - 1. Manufacturers: Subject to compliance with requirements, provide signage by one of the manufacturers specified.
 - a. A.R.K. Ramos
 - b. ASI – Sign Systems, Inc.
 - c. Innerface Sign Systems, Inc.
 - d. Metal Arts; Div. of L & H Mfg.
 - e. Metallic Arts
 - f. Mohawk Sign Systems
 - g. Southwell Co.
 - h. Gemini Incorp.
 - i. ACE Sign Systems
 - j. Jarob
 - k. Mathews International
 - l. Interior Graphic Systems
 - m. Ellet Sign Company
 - n. Cosco
 - o. Essential Architectural Signs
 - p. Landmark Sign
 - 2. Character Material: Cast aluminum.
 - 3. Character Height: As indicated on Drawings.
 - 4. Thickness: Manufacturer's standard for size of character.
 - 5. Finishes:
 - a. Powder-Coat Finish: Custom color to match "school color" as supplied by A/E and Owner.
 - b. Overcoat: Manufacturer's standard baked-on clear coating.
 - 6. Mounting: Concealed studs.
 - 7. Typeface: As indicated on Drawings.
 - 8. Location: Exterior.

2.3 DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Castings: ASTM B 26, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.

2. Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
- B. Adhesive: As recommended by sign manufacturer. Do not use double faced tape without adhesive.

2.5 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. 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.
 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 5. Internally brace signs for stability and for securing fasteners.
 6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
 7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.6 GENERAL FINISH REQUIREMENTS

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

2.7 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that electrical service is correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - 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.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 19

SECTION 10 14 23.16 – INTERIOR PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Plaques (dedication).
 - 2. Panel signs, including room-identification signs that are directly attached to building.
 - a. Acrylic
 - 3. Custom graphic panels
- B. Related Sections include the following:
 - 1. Division 26 Section "Interior Lighting" for illuminated Exit signs.

1.2 DEFINITIONS

- A. Accessibility Standard: U.S. Department of Justice's "2010 ADA Standards for Accessible Design."

1.3 COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for signs.
 - 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:

1.5 CLOSEOUT SUBMITTALS:

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For signs to include in maintenance manuals.
 - 2. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Signage shall be provided to conform to the USDOJ's "2010 ADA Standards for Accessible Design", ICC/ANSI A117.1, and State and Local Regulations. These requirements supersede Technical Specifications in this Section.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which 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, colors, and sign lamination.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers: Subject to compliance with requirements, provide signage by one of the manufacturers specified.
 - 1. Dedication (Cast Metal) Plaque and Exterior Room Name and Number Signs
 - a. A.R.K. Ramos
 - b. Matthews International Corp.
 - c. Metal Arts; Div. of L & H Mfg.
 - d. Southwell Co.
 - e. ACE Sign Systems
 - f. Diskey Architectural Signage
 - g. Forty-Nine Degrees
 - h. Jarob
 - i. Gemini Incorp
 - j. Dixie Graphics
 - k. Interior Graphic Systems
 - 2. Panel Signs
 - a. Acrylic
 - 1) ASI Sign Systems, Inc.
 - 2) Advance Corporation
 - 3) Diskey Architectural Signage
 - 4) 2/90 Sign Systems
 - 5) ACS Sign Systems
 - 6) Forty-Nine Degrees
 - 7) Interior Graphic Systems
 - 8) ACE Sign Systems
 - 9) ASE, Inc.
 - 10) Best Sign Systems
 - 11) Contemporary Plastics Inc.
 - 12) Essential Architectural Signs, Inc.
 - 13) Jarob
 - 14) Roban Signs
 - 15) Sign Solutions
 - 16) Appenx Architectural Signage
 - 17) Ellet Sign Company
 - 18) Sign PDQ
 - 19) REM Graphics and Signs LLC; Raster Braille Signage
 - 20) Identity Group Interior Sign Solution
 - 21) ISF Signs (Indianapolis)
 - 22) FastSigns
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" Sample sign, and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design," ICC A117.1, and requirements of authorities with jurisdiction for signs.

2.3 MATERIALS

- A. Bronze Castings: ASTM B 584, Alloy UNS No. C86500 (No. 1 manganese bronze).
- B. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVF (UV filtering).
- 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.

2.4 PLAQUES

- A. Cast Plaques: Provide castings free of pits, scale, sand holes, and other defects, as follows:
 - 1. Plaque Material: Bronze.
 - 2. Background Texture: Manufacturer's standard pebble texture.
 - 3. Border Style: Square, polished.
 - 4. Mounting: Concealed studs, noncorroding for substrates encountered.

2.5 PANEL SIGNS (INTERIOR SIGNAGE)

- A. Signage, General:
 - 1. Graphic Process: Comply with ADA Accessibility Guidelines and ICC/ANSI A117.1. All letters, numbers, and/or symbols shall contrast with background either light characters on a dark background or dark characters on a light background. Characters and background shall have matte finish.
 - a. Graphic Content and Style: Provide sign copy that complies with requirements indicated for size, style, spacing, content, mounting height and location, material, finishes, and color of signage.
 - 2. Characters: Letters and numbers shall have width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between 1:5 and 1:10. Letters and numbers shall be raised 1/32-inch, uppercase, sans serif or simple sans serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be 5/8-inch high minimum and 2 inches high maximum. Equivalent written description must be placed directly below pictogram. Pictogram can be any size within a minimum field of 6 inches in height. Produce precisely formed characters with square cut edges free from burrs and cut marks.
- B. Material:
 - 1. Acrylic Panel, fabricated in accordance with one of the following methods:
 - a. Acrylic signs
 - 1) Acrylic sheet shall be CNC cut to specifications with square or radius corners, and/or custom shapes, 0.080 inch minimum.
 - 2) 1/32 inch modified acrylic plate shall be adhered to the acrylic plate with a high bond chemical adhesive and the text and/or symbols shall be CNC cut to specifications.
 - a) Option: One layer of 1/4 inch acrylic with .062 inch backer when needed.
 - 3) Corresponding text and/or symbols shall be CNC cut from 1/16 inch modified acrylic embedded 1/32 inch and bond with chemical adhesive to the acrylic plate.
 - 4) Domed grade 2 Braille shall be embedded in the surface.
 - 5) Comply with requirements indicated for material, color, finish, design, shape, size, and details of construction.

- b. Double panel (window) sign with changeable insert(s).
 - 1) Tactile appliqué: Opaque, single ply, modified acrylic sheet not less than 0.032 inch in thickness.
 - 2) Braille: Braille dots shall consist of 0.0625 optically clear UV stable acrylic spheres.
 - 3) Face laminate: Clear, non-glare, cast acrylic sheet not less than 0.080 inch in thickness.
 - 4) Backing sheet: Expanded PVC sign board or acrylic sheet not less than 0.125 inch in thickness.
 - 5) Changeable insert: Provide one of the following:
 - a) Paper inserts by Owner.
- C. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to comply with the following requirements:
 - 1. Edge Condition: Eased, unless otherwise noted.
 - 2. Corner Condition: Rounded to a 3/8 inch radius, unless otherwise noted.
 - 3. Backer Sheet: Include a solid backer, 1/8 inch thick of acrylic sheet for all signs occurring on glass sidelights. Color shall match sign background color.

2.6 CUSTOM GRAPHIC ACRYLIC PANELS

- A. Back-printed acrylic sign panels: 1/4 inch thick clear acrylic signage board with custom graphic printed on back of acrylic.
 - 1. Multi-color graphic printing with ink for permanent image.
 - 2. Mounting: Aluminum standoffs with screw cap. Size as indicated on Drawings.
 - 3. Unframed finished edges of acrylic sheet.
 - 4. A/E to supply graphic images at later date.

2.7 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, 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.
 - 3. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.
- B. Two-Face Tape: Use double-sided vinyl tape or silicone adhesive fabricated from materials that are not corrosive to sign material and mounting surface.
- C. Adhesive: As recommended by sign manufacturer.

2.8 FABRICATION

- A. General: Provide manufacturer's standard signs of configurations indicated.
 - 1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
 - 2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
 - 3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
 - 4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
 - 5. Internally brace signs for stability and for securing fasteners.

6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Subsurface-Applied Graphics: Apply graphics to back face of clear faced-sheet material to produce precisely formed image. Image shall be free of rough edges.
- C. Shop and Subsurface-Applied Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fish mouths.

2.9 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: 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.

2.10 ACRYLIC SHEET FINISHES

- A. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of 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 anchor inserts are correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs and accessories, using mounting methods of types described and complying with manufacturer's written instructions.
 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 4. Install signs so they do not protrude or obstruct according to the accessibility standard.

- B. Accessibility Signs: Installation height and location shall comply with applicable provisions in the U.S. Architectural and Transportations Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.
 - 1. Height above finish floor or ground: Tactile characters on signs shall be located 48 inches minimum above the "finish" floor or ground surface, measured from the base line of the lowest tactile character and 60 inches maximum above the finish floor or ground surface, measured from the baseline of the height tactile character.
 - a. Exception: Tactile characters for elevator car controls shall not be required to comply.
 - 2. Location: Where a tactile sign is provided at a door, the sign shall be located alongside the door latch side. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located on the inactive leaf. Where a tactile sign is provided at double doors with two active leaves, the sign shall be located to the right of the right hand door. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall. Signs containing tactile characters shall be located so that a clear floor space of 18 inches minimum by 18 inches minimum, centered on tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.
 - a. Exception: Signs with tactile characters shall be permitted on the push side of doors with closures and without hold-open devices.
- C. Wall-Mounted Panel Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
 - 1. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces. Use double-sided tape when recommended by sign manufacturer to hold sign in place until adhesive has fully cured. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
 - 2. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
 - 3. Shim Plate Mounting: Provide 1/8 inch thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
 - 4. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.
- D. Cast-Metal Plaques: Mount plaques using standard fastening methods to comply with manufacturer's written instructions for type of wall surface indicated.
 - 1. Concealed Mounting: Mount plaques by inserting threaded studs into tapped lugs on back of plaque. Set in predrilled holes filled with quick-setting cement.

3.3 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 10 14 00

SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Impact-resistant wall coverings.
- B. Related Sections include the following:
 - 1. Division 09 Section "Gypsum Board Assemblies" for supplementary framing and blocking installed in locations required to secure attachment of support fasteners.

1.2 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, impact strength, fire test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall-protection unit.
 - 1. Include installation methods for each substrate type.
- B. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated.
 - 1. Include similar Samples of accent strips and accessories involving color selection.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide impact-resistant, plastic wall-protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store impact-resistant wall-protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
 - 2. Keep plastic sheet material out of direct sunlight.
 - 3. Store plastic wall-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
 - a. Store corner-guard covers in a vertical position.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install impact-resistant wall-protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.
- B. Field Measurements: Verify actual locations of walls, columns, and other construction contiguous with impact-resistant wall-protection units by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall-protection units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Deterioration of plastic and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - 2. Basis-of-Design Product: The design for each impact-resistant wall-protection unit is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 MATERIALS

- A. Extruded Rigid Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; thickness as indicated.
 - 1. Impact Resistance: Minimum 25.4 ft-lbflin. of notch when tested according to ASTM D 256, Test Method A.
 - 2. Chemical and Stain Resistance: Tested according to ASTM D 543.
 - 3. Self-extinguishing when tested according to ASTM D 635.
 - 4. Flame-Spread Index: 25 or less.
 - 5. Smoke-Developed Index: 450 or less.
- B. Plastic Sheet Wall Covering Material: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, semirigid, high-impact-resistant PVC or acrylic-modified vinyl plastic sheet with integral color throughout; thickness as indicated.
 - 1. Impact Resistance: Minimum 25.4 ft-lbflin. of notch when tested according to ASTM D 256, Test Method A.
 - 2. Chemical and Stain Resistance: Tested according to ASTM D 543.
 - 3. Self-extinguishing when tested according to ASTM D 635.
 - 4. Flame-Spread Index: 25 or less.
 - 5. Smoke-Developed Index: 450 or less.
- C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- D. Adhesive: Type recommended by manufacturer for use with material being adhered to substrate indicated.

2.3 IMPACT-RESISTANT WALL COVERINGS

- A. Semirigid, Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall covering material.
 - 1. Manufacturers:
 - a. Construction Specialties, Inc.
 - b. American Floor Products Co., Inc.
 - c. Tepropmark.
 - d. IPC Door and Wall Protection Systems; Division of InPro Corporation.
 - e. Korogard Wall Protection Systems; Division of RJF International Corporation.
 - f. Pawling Corporation.
 - g. Nystrom, Inc.
 - 2. Size: 48 by 96 inches for sheet. Cut to size required.
 - 3. Sheet Thickness: 0.040 inch.
 - 4. Color and Texture: Refer to "List of Finishes".
 - 5. Height: As indicated.
 - 6. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
 - 7. Mounting: Adhesive.

2.4 FABRICATION

- A. Fabricate impact-resistant wall-protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
- B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of work.
 - 1. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing impact-resistant wallprotection system components.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Impact-Resistant Wall Covering: Provide top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 00

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes following:
 - 1. Public-use washroom accessories.
 - 2. Public-use shower room accessories.
 - 3. Custodial accessories.
- B. Owner-Furnished and Contractor Installed Material: Paper towel dispenser, Soap dispenser and toilet paper dispensers.

1.2 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying Work.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include following:
 - 1. Construction detail, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Electrical characteristics.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.

1.4 CLOSEOUT SUBMITTALS:

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For toilet and bath accessories to include in maintenance manuals; including replacement parts information.
 - 2. Warranty: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Accessibility Requirements: Comply with requirements applicable in jurisdiction of project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.
 - 1. Where bottoms of units are between 27 and 80 inches above finished floor, accessories mounted on or in wall cannot protrude more than 4 inches into a clear access aisle.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations.

1.7 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: Comply with requirements applicable in jurisdiction of project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.
 - 1. Where bottoms of units are between 27 and 80 inches above finished floor, accessories mounted on or in wall cannot protrude more than 4 inches into a clear access aisle.
- B. Structural Performance: Accessories and fasteners to comply with the following requirements:
 - 1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
 - 2. Shower Seats: Installed units are able to resist 250 lbf applied in any direction and at any point.

2.2 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
 - 2. Products: Subject to compliance with requirements, provide one of specified products.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. Requests for A/E's approval and complete technical data for evaluation must be received at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.3 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008, Designation CS (cold-rolled, commercial steel), 0.0359-inch minimum nominal thickness.
- C. Galvanized-Steel Sheet: ASTM A 653, with G60 hot-dip zinc coating.
- D. Galvanized-Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0-mm thick.
 - 1. Provide mirror furnished with a uniform plastic film 8 mils nominal thickness with acrylic adhesive which is moisture resistant and non-corrosive, meeting 16 CFR 1201-11 and ANSI 297.1 requirements category II tape back.
- H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.4 PUBLIC-USE WASHROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
1. AJW Architectural Products
 2. American Specialties, Inc.
 3. Bobrick Washroom Equipment, Inc.
 4. Bradley Corporation.
 5. GAMCO Commercial Restroom Accessories Division, Bobrick Washroom Equipment, Inc.
- B. Grab Bar:
1. Stainless Steel Type: Provide grab bars with wall thickness not less than 0.05 inch and as follows:
 - a. Mounting: Concealed, manufacturer's standard flanges and anchorages.
 - b. Clearance: 1-1/2-inch clearance between wall surface and inside face of bar.
 - c. Gripping Surfaces
 - 1) Smooth, satin finish, unless noted otherwise.
 - 2) Manufacturer's standard nonslip texture in wet areas (showers).
 - d. Heavy-Duty Size: Outside diameter of 1-1/4 inches minimum.
 2. Grab bar shall be constructed of Type 304 stainless steel with satin finish. Concealed mounting flanges shall be 1/8-inch thick stainless-steel plate, 3-1/8 inch diameter, and each shall have 2 screw holes for attachment to wall. Flange covers shall be 0.03125-inch thick (fka 22-gauge), 3-1/4-inch diameter by 1/2-inch deep, and shall snap over mounting flange to conceal mounting screws. Ends of grab bars shall pass through concealed mounting flanges and be heliarc-welded to form one structural unit. Grab bars shall comply with ADA Accessibility Guidelines for structural strength. Provide concealed anchor device or backing as specified or required in accordance with local building codes before wall is finished.
 - a. Products:
 - 1) Bobrick: B-5806 Series
 - 2) Bradley: 832-001 Series
 - 3) AJW Architectural Products: UG2 Series
 - 4) American Specialties: 3700 Series
 - 5) Gamco: 125S-Series
- C. Sanitary-Napkin/Tampon Accessories:
1. Surface-Mounted Partition Mounted Sanitary-Napkin/Tampon Disposal (ND-1): Surface-mounted sanitary-napkin disposal shall be Type 304 stainless steel with all-welded construction; exposed surfaces shall have satin finish. Self-closing door shall be secured to cabinet with a spring-loaded, full-length, stainless-steel piano hinge and equipped with international graphic symbol identified sanitary-napkin disposal. Unit shall be furnished with a removable stainless-steel receptacle that is equipped with a tumbler lock. Receptacle shall have a capacity of 1.2 gallons.
 - a. Products:
 - 1) Bobrick: B-254
 - 2) Bradley: 4722-150000
 - 3) AJW Architectural Products: U582/IGS
 - 4) American Specialties: 0473-1A
 - 5) Gamco: ND-5

D. Mirrors

1. Stainless-Steel Framed Mirror (M-1, M-2): Mirror shall have a one-piece, Type 304 stainless-steel angle frame, 3/4 inch by 3/4 inch with continuous integral stiffener on all sides and beveled front to hold frame tightly against mirror; corners shall be heliarc-welded, ground, and polished smooth; all exposed surfaces shall have satin finish with vertical grain. Float/plate glass mirror shall be guaranteed for 15 years against silver spoilage. All edges shall be protected by plastic filler strips and back shall be protected by full-size, shock-absorbing, water-resistant, nonabrasive, 1/8-inch thick polyethylene padding. Corrugated cardboard is not an acceptable filler material. Galvanized-steel back shall have integral hanging brackets for mounting on concealed rectangular wall hanger(s). Mirror shall be secured to hanger(s) with concealed Phillips-head locking screws located in bottom of frame.
 - a. Products:
 - 1) Bobrick: B-290
 - 2) Bradley: MIR780
 - 3) AJW Architectural Products: U700
 - 4) American Specialties: 0600
 - 5) Gamco: A-Series

2.5 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of following:

1. AJW Architectural Products.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. GAMCO Commercial Restroom Accessories Division, Bobrick Washroom Equipment, Inc.

B. Folding Shower Seat:

1. Folding Shower Seat (SS1): Folding shower seat shall have a frame constructed of Type 304, satin-finish stainless steel that consists of 0.0625-inch thick (fka 16-gauge) 1-1/4-inch square tubing and 0.0500-inch thick (fka 18-gauge), 1-inch diameter seamless tubing. Seat shall consist of 6 slats constructed of 5/16-inch thick, solidly fused plastic laminate with matte finish melamine surfaces, ivory-colored face sheets, and black phenolic resin core; secured to frame with stainless-steel carriage bolts and acorn nuts. Shower seat shall be equipped with two 3-inch diameter mounting flanges constructed of Type 304, 3/16-inch thick satin-finish stainless steel; a guide bracket constructed of Type 304, 0.0625-inch thick (fka 16-gauge), satin-finish stainless steel; and a spring constructed of Type 304, 0.0250-inch thick (fka 24-gauge) stainless steel that is spot-welded to base plate of Type 304, heavy-gauge stainless steel. Seat shall be able to lock in upright position when not in use. Shower seat shall comply with ADA Accessibility Guidelines for structural strength.
 - a. Products:
 - 1) Bobrick: B-5181
 - 2) Bradley: 9569
 - 3) AJW Architectural Products: U929
 - 4) American Specialties: 8206-R/8206-L
 - 5) Gamco: 5181

C. Towel Hooks (TH):

1. Surface-mounted stainless-steel towel pin shall be constructed entirely of Type 304 stainless steel with bright polished finish. Flange shall be equipped with 0.0625-inch thick (fka 16-gauge) mounting bracket which locks to concealed 0.0625-inch thick (fka 16-gauge) wall plate with stainless-steel lock screw. Cap shall be 0.1406-inch thick (fka 10-gauge) stainless steel, welded to post.
 - a. Products:
 - 1) Bobrick: B-7671
 - 2) Bradley: 9115
 - 3) AJW Architectural Products: UX110BF

- 4) American Specialties: 7340-B
- 5) Gamco: 7671

2.6 CUSTODIAL ACCESSORIES

- A. Manufacturers:
 - 1. AJW Architectural Products.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.
 - 5. GAMCO Commercial Restroom Division, Bobrick Washroom Equipment, Inc.
- B. Mop and Broom Holder:
 - 1. Mop and Broom Holders (MH): Surface-mounted mop and broom holder shall be Type 304 stainless steel with satin finish. Unit shall be 36-inches long with 4 spring-loaded, rubber cam holders.
 - a. Products:
 - 1) Bobrick: B-223-XX
 - 2) Bradley: 995X
 - 3) AJW Architectural Products: UJ13B
 - 4) American Specialties: 8215
 - 5) Gamco: MS

2.7 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation, as follows:
- C. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate requirements for blocking and construction of wall openings for recessed units.
- B. Provide templates and rough-in measurements as required.

3.2 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
 - 1. Verify blocking, if required, has been installed properly.
 - 2. Verify location does not interfere with door swings or use of fixtures.
 - 3. Comply with manufacturer's recommendations for backing and proper support.
 - 4. Use vandal-resistant fasteners and anchors suitable for substrate and project conditions.
 - 5. Conceal evidence of drilling, cutting, and fitting to room finish.
 - 6. Test for proper operation.
- B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.

- C. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.3 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

SECTION 10 41 16 – LOCK BOX

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Furnishing and installing fire department lock boxes for building master key(s) as indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design: Heavy-duty key vault, recessed mounted. Subject to compliance with requirements (including approval by the local fire department), provide a product manufactured by one of the following:
 - 1. ABLOY Security, Inc.; an ASSA ABLOY Group Company.
 - 2. Knox Box
 - 3. Supra Products.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least ten days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 FABRICATION

- A. Provide boxes with the following components and properties:
 - 1. Rough-in Dimensions: 6-inches high by 6-inches wide by 4-inches deep.
 - 2. Provide lock box with 1/4-inch thick plate steel housing and 1/2-inch thick solid steel door.
 - 3. Door gasket seal for weather protection and 1/8-inch thick stainless steel dust cover with tamper seal mounting capability.
 - 4. Steel Finish: Pre-treatment zinc phosphate, F.S. TT-C-490, Type II.
 - 5. Boxes and lock shall be UL-listed.
 - 6. Lock shall have double action rotating tumblers and hardened steel pins, accessed by a bias-cut key.
 - 7. Provide recessed mounting kit.
 - 8. Finish Color: As selected by A/E from manufacturer's standard colors and finishes.
- B. Order form for lock boxes and padlock shall be obtained and signed by an authorized officer of the local fire department.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install lock boxes and accessories as recommended by manufacturer at location indicated.
 - 1. Set-in-place during masonry wall construction.

END OF SECTION 10 41 16

SECTION 10 44 13 - FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Sections:
 - 1. Division 10 Section "Fire Extinguishers."

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination
 - 1. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
 - a. Field Measurement: Verify dimensions of existing recessed wall openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 2. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.3 CLOSEOUT SUBMITTALS:

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. U.S. Architectural and Transportation Barriers Compliance Board, Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG), Adopted in 1991; Continual revisions as published in Federal Register.
 - 1. These regulations shall supersede Technical Specifications of this Section.

2.3 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B.

- B. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).
 - 1. Note: Wire glass and acrylic sheets are not acceptable.

2.4 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fire End & Croker Corporation.
 - b. J. L. Industries, Inc., a division of Activar Construction Products Group.
 - c. Larsen's Manufacturing Company.
 - d. Modern Metal Products, Division of Technico Inc.
 - e. Guardian Fire Equipment, Inc.
 - f. Potter Roemer LLC; Alta Series.
 - g. Moon American.
 - h. Nystrom, Inc.
 - i. Strike First Corp. of America.
 - j. Babcock-Davis.
- B. Cabinet Material: Steel sheet.
- C. Semirecessed Cabinet (SR-): Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
 - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- D. Cabinet Trim Material: Same material and finish as door.
- E. Door Material: Steel sheet.
- F. Door Style:
 - 1. Vertical duo panel with frame, unless otherwise noted.
 - 2. Solid opaque panel with frame, in gymnasium or similar multi-purpose spaces and where noted.
- G. Door Glazing: Tempered float glass (clear).
- H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide recessed door pull and friction latch.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- I. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - a. Identify fire extinguisher in fire protection cabinet with the words "**FIRE EXTINGUISHER.**"
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Silk-screened, engraved, etched, or die cut.
 - a) Pressure-sensitive vinyl letters or decals are not acceptable.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.

- J. Finishes:
 - 1. Manufacturer's standard baked-enamel paint for the following:
 - a. Exterior of cabinet door and trim except for those surfaces indicated to receive another finish.
 - b. Interior of cabinet and door.
 - 2. Steel: Baked enamel or powder coat.

2.5 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Provide factory-drilled mounting holes.
 - 3. Miter corners and grind smooth.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick, unless otherwise noted.
 - 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 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". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
 - 1. Color and Gloss: White.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where fully recessed and semi-recessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for fully recessed and semi-recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide semi-recessed fire protection cabinets.
 - 2. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
 - 3. Seal any through penetration with firestopping sealant as specified in Division 07 Section "Penetration Firestopping".
- C. Identification: Apply decals or vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturers 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 10 44 13

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Sections:
 - 1. Division 10 Section "Fire Extinguisher Cabinets."

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination
 - 1. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.3 CLOSEOUT SUBMITTALS:

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Warranty: Sample of special warranty.
 - 2. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, following:
 - a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within warranty period.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
 - 1. Portable Fire Extinguishers
 - a. Amerex Corp.
 - b. Ansul Inc.
 - c. Bobcock-Davis
 - d. Badger Fire Protection
 - e. Buckeye Fire Equipment Company
 - f. Fire End and Croker Corp.
 - g. Guardian Fire Equipment, Inc.
 - h. J.L. Industries; a division of Activar Construction Products Group

- i. Kidde, Residential and Commercial Div., UTC Fire and Security Co., United Technologies Corp.
 - j. Larsen's Manufacturing Company
 - k. Moon America
 - l. Nystron Building Products
 - m. Potter-Roemer
 - n. Pem All Fire Extinguisher Company, A Division of PEM System
 - o. Pyro-Chem, Tyco Safety Products
 - p. Strike First Corp. of America
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations: Obtain fire extinguisher, fire-protection cabinets, and accessories, from a single source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers".
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.3 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.
 - 1. Valves: Manufacturer's standard, unless otherwise noted.
 - 2. Handles and Levers: Manufacturer's standard, unless otherwise noted.
 - a. Gauge face cover and horn cone parts shall be metal. No plastic or nylon valves, trigger/handle, casing, or gauge will be acceptable.
 - 3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel or Aluminum Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled container.
 - 1. Provide this type throughout facility, unless otherwise noted.

2.4 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical or horizontal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: 48 inches above finished floor to handle of fire extinguisher, unless required by authorities with jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

12

DIVISION

FURNISHINGS

SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. Manually operated roller shades with single rollers.
- B. Related Sections include the following:
 - 1. Division 06 Section "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
 - 2. Division 09 Section "Gypsum Board Assemblies" for coordination with gypsum ceilings, soffits, and bulkheads.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.
 - 1. Preparation instructions and recommendations.
 - 2. Installation and maintenance instructions.
 - 3. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operation instructions.
 - 4. Storage and handling requirements and recommendations.
 - 5. Mounting details and installation methods.
- B. Samples for Initial Selection: For each colored component of each type of shade indicated.
 - 1. Include similar Samples of accessories involving color selection.

1.3 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:
 - a. Methods for maintaining roller shades and finishes.
 - b. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
 - c. Operating hardware.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Flame-Resistance Ratings: Passes NFPA 701.
- B. Product Standard: Provide roller shades complying with WCMA A 100.1.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in factory packages, marked with manufacturer and product name, fire-test-response characteristics, lead-free designation, and location of installation using same designations indicated on Drawings.
- B. Label containers and shades according to Window Shade Schedule.

- C. Store products in manufacturer's unopened packaging until ready for installation.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operating hardware throughout the entire operating range. Notify A/E of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Manual Shades
 - a. MechoShade Systems, Inc.
 - b. Draper Inc.
 - c. Lutron Electronics Co. Inc.
 - d. DFB Sales, Sol-R-Shades
 - e. Hunter Douglas Contract, Nysan Roller Shades
 - f. Lafayette Interior Fashions, (Genesis Roller Shades)
 - g. Legrand Commercial Shading
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Manufacturer's standard
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Chain tensioner, jamb mounted unless otherwise noted.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 - 1. Roller Drive-End Location: Right side of inside face of shade, unless otherwise noted.
 - 2. Direction of Shadeband Roll: Regular, from back of roller.
 - 3. Shadeband-to-Roller Attachment: Removable spline fitting integral channel in tube.
 - 4. Fabric Length: 6 inches greater than opening height minimum.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

- E. Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; length as required to conceal shade and operating mechanisms; removable design for access.
 - 1. Architect to select color from Manufacturers Standard color offerings.
- F. Bottom Bar: Steel or extruded aluminum, with plastic or metal capped ends. Provide concealed, by pocket of shade material, internal-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.
- G. Shadebands:
 - 1. Shadeband Material: Light-filtering fabric
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Manufacturer's standard.
 - b. Color and Finish: As selected by A/E from manufacturer's full range

2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 - 1. Basis-of-Design: Subject to compliance with requirements provide the shadeband material indicated herein or a comparable fabric recommended by one of the shade manufacturers listed.
 - a. Series SW2700 SheerWeave: Duplex basketweave fabric – light exterior color combined with dark interior color for thermal comfort and view-through. Fire rating: NFPA 701.
 - 1) SW2705: 3 percent open.
 - 2. Color: As selected from manufacturer's full range

2.4 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.01, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg. F.
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or –floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.

- B. Coordinate requirements for power supply conduct, and wiring required for window shade motors and controls.

3.3 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
- B. Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.
 - 1. End caps.
 - 2. Fascia

3.4 ADJUSTING/TESTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- B. Test window shades to verify that operating mechanism, fabric retainer, and other operating components are functional. Correct deficiencies.

3.5 CLEANING AND PROTECTION

- A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by A/E, before time of Substantial Completion.

END OF SECTION 12 24 13

SECTION 12 48 26.01 – ENTRANCE CARPET TILE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. Entrance carpet tile (ECT).
- B. Related Sections include the following:
 - 1. Division 09 Section "Tile Carpeting" for modular carpet tiles.

1.2 ACTION SUBMITTALS

- A. Samples for Verification: For each type of product indicated.
 - 1. Size: 8-1/2 by 11 inch square, assembled sections.

1.3 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For floor mats to include in maintenance manuals.
 - 2. Extra Materials: Receipt for extra materials.

1.4 MAINTENANCE MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Entrance Carpet Tiles: Full-size units equal to 2 percent of amount installed for each size, color, and pattern indicated, but no fewer than 10 units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - 3. Basis-of-Design Product: The design for entrance floor mats and frames is based on products named. Subject to compliance with requirements, provide either the name product or a comparable product by one of the other manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 ENTRANCE CARPET TILE

- A. General: Refer to "List of Finishes."

- B. Entrance Tile; carpet tiles shall be specifically designed for use in entries to reduce the amount of contaminants tracked into occupied space.
 - 1. Indoor Air Quality (IAQ): CRI IAQ Certification "Green Label Plus".
 - 2. Flammability – Radiant Panel Test: Class I, ASTM E648.
 - 3. NBS Smoke: <450 Flaming Mode, ASTM E662.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and floor conditions for compliance with requirements for location, sizes, and other conditions affecting installation of floor mats and frames.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, ENTRANCE CARPET TILE

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

END OF SECTION 12 48 26.01