
Technical Specifications

SECTION 031000 – CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESIGN FORMWORK

- A. Assume all responsibility for the design and engineering of the formwork, as well as its construction and removal.
- B. Design formwork for the loads, lateral pressure, and allowable stresses outlined in Chapter 2, "Guide to Formwork for Concrete", ACI 347, latest edition.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Facing Materials shall be such as to provide the specified surface finish.
- B. Form Coating shall be a field applied chemical concrete release agent capable of preventing bond between poured concrete and the form and shall contain no oil, or shall be factory applied non-absorptive liner. Coat form before reinforcement is placed.
- C. Form Ties shall be broken back at 1-inch from surface of concrete. Tie Cones, 1-inch diameter by 1-inch long, shall be used on all exposed concrete.
- D. Pre-molded Expansion Joint material (E.J.) shall conform to ASTM D1751, "Preformed Expansion Joint Fillers for Concrete Paving and Structural Concrete (non-extruding and resilient bituminous types)".

2.2 FABRICATION

- A. Construct formwork so that concrete surfaces will conform to the tolerance limits specified in Table 4.3.1, "Tolerances for Formed Surfaces", ACI 301, latest edition.
- B. Provide positive means of adjustment (wedges or jacks) of shores and struts to compensate for anticipated deflections and settlement in the Formwork during concrete placing operations.

PART 3 - EXECUTION

3.1 ERECTION OF FORMS

- A. Build forms tight to prevent loss of mortar from the concrete.

- B. Provide clean-out openings at base of pier and wall forms to facilitate cleaning and observation immediately before concrete is placed.
- C. Unless shown otherwise on drawings, corners of concrete members exposed to view after all other finish materials are in place shall be beveled by the use of chamfer strips (maximum ½-inch across the beveled face) placed in the forms. Submit sample for approval before proceeding.
- D. Overlap and hold forms against hardened concrete of a previous placement to prevent offsets or loss of mortar at the construction joint and to maintain a true surface.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. Install inserts and materials to be cast into concrete.
- B. Set 1-inch deep 24-gage galvanized iron wall slots in all concrete surfaces adjacent to brick or block masonry. Slots shall be set vertical in concrete surfaces and spaced 16-inches on center horizontally. Provide masonry anchors spaced 16-inches on center vertically in each wall slot.
- C. Separate parallel runs of conduit by not less than 1-inch. Do not displace reinforcing bars from positions. No conduit shall be greater than ½ slab thickness. Bury conduit in slabs.
- D. Install Adjustable Wedge Inserts at 32-inches on center in concrete for shelf angles.

3.3 REMOVAL OF FORMS

- A. Horizontal member forms used to support the weight of concrete of structural members shall remain in place until the concrete has gained not less than 2/3 of the specified 28-day strength, or a minimum of 7 days.
- B. Vertical member forms and forms not supporting the weight of concrete shall not be removed in less than 24 hours.

END OF SECTION 031000

SECTION 032000 – CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Submit six copies of shop drawings for the fabrication and placing of reinforcing steel for approval, after being checked and approved by the contractor and before proceeding. Any changes by contractor or Fabricator of contract document details, materials, member sizes, or reinforcement shall be "flagged" on shop drawings accompanied by a written request for authorization and reason for requested change.
- B. Placing plans shall show all dimensions, details, notes, locations, sizes, lengths and each bar mark together with accessories and material belonging to the reinforcing for the concrete.
- C. Schedules shall show all information and be of the same form as those on the contract drawings.
- D. Concrete wall reinforcing shall be shown in elevation.
- E. Detail all reinforcing steel in accordance with the "ACI Detailing Manual", ACI Publication SP-66 (2004), unless otherwise indicated on the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforcement shall be fabricated from ASTM A615 "Deformed Billet-Steel Bars for Concrete Reinforcement", Grade 60.
- B. Reinforcement to be welded shall be fabricated from ASTM A706 "Low Alloy Steel Deformed Bars for Concrete, Grade 60.
- C. Welded smooth wire fabric (WWF) shall conform to "Specifications for Welded Steel Wire Fabric for Concrete Reinforcement", ASTM A185, and shall be fabricated from plain wire conforming to "Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement", ASTM A82.
- D. Wire bar supports shall conform to the National Bureau of Standards PS7, "Wire Bar Supports for Reinforced Concrete Construction".

2.2 FABRICATION

- A. All hooks shall be bent using the pin diameters and dimensions as "ACI Standard Hooks" in the "Manual of Standard Practice for Reinforced Concrete Construction", CRSI latest edition, unless otherwise shown on the plans.
- B. Reinforcing bars shall not be bent or straightened in a manner that will injure the materials.
- C. Reinforcing bars shall conform to the dimensions shown on the plans and within the fabricating tolerances as shown in the "Manual of Standard Practices for Reinforced Concrete Construction", CRSI latest Edition.

PART 3 - EXECUTION

3.1 PLACEMENT/BAR REINFORCEMENT

- A. Bar reinforcement shall be placed in specified positions in the forms and held in place, before and during the placing of concrete by means of bar supports, to carry the reinforcing bars they support within the following tolerances from the positions shown on the drawings or specified herein:
 - 1. For clear concrete protection and for depth "d" in Flexural members, walls, and compression members where "d" is:
 - a. 8 inches or less – plus or minus 1/4"
 - b. More than 8 inches but less than 24 inches – plus or minus 1/2" , but the cover shall not be reduced by more than one-half of the specified cover.
 - 2. For longitudinal location of bends and end of bars:
 - a. +2 inches except at discontinuous ends of member where tolerance shall be + 1/2 inch.
 - 3. For spacing
 - a. +2 inches except that total number of bars shall not be reduced.
- B. Except as shown otherwise on structural drawings, concrete cover for Reinforcing Bars shall be as follows:
 - 1. Cast against and permanently exposed to earth – 3 inches
 - 2. Exposed to earth or weather – 2 inches
 - 3. Interior formed surfaces:

- a. Piers and Columns – 1/2 inch
 - b. Beams – 1/2 inch
 - c. Walls – 3/4 inch
 - d. Slabs & Joists – 3/4 inch
- C. "Continuous" bars, unless otherwise indicated on drawings, shall be lapped 36 diameters at splices. Provide corner bars to match primary reinforcing at all corner conditions, including continuous wall footings and grade beams.
- D. Splices not shown in contract documents shall be subject to approval.
- E. Support all reinforcing bars.
- F. Space bar supports a maximum of 4-feet on center with the first support not greater than 2-feet from the ends of the bars. Tie to prevent displacement during the concreting operations. Provide #4 support bars at 48-inches spacing where not supported by perpendicular reinforcement.
- G. Reinforcement shall not be "field" bent after being embedded in hardened concrete except where specifically shown on the drawings.
- H. Set and hold all vertical dowels in footings by template.

3.2 WELDING REINFORCEMENT

- A. The welding of reinforcing bars will be permitted only on approval on the shop drawings by the Architect.
- B. The welding of reinforcing bars at intersections for support purposes, in lieu of tie wire, is prohibited.
- C. The welding of reinforcing bars shall be performed in accordance with "Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections for Reinforced Concrete Construction", AWS D 12.1-latest edition, as published by the American Welding Society.
- D. Welders shall be qualified by tests as prescribed in the "Standard Qualification Procedures, " AWS B 3.0-latest edition, as published by the American Welding Society.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RESPONSIBILITY AND QUALIFICATIONS

- A. Assume all responsibility for the work, design and engineering of the formwork and the safe support of property adjacent to the work.
- B. Work shall be done by one qualified to install the concrete work in accordance with the drawings and specifications. Minimum requirement for qualification shall be five years' experience with satisfactory completion of at least five similar projects.

1.2 SUBMITTALS

- A. Submit six shop drawings for the fabrication and placing of reinforcing steel after being checked and approved by the Contractor and before proceeding. Submit no "Approved as Corrected" drawings for approval.
- B. Design and submit mix design series along with test data from laboratory or field experience (6 copies) corresponding to the same mix design.
 - 1. Concrete shall have 28 day compressive strength as indicated on the drawings.
- C. Test reports shall show the requirements of ASTM specifications.
- D. Shop Drawings shall be submitted in complete sets of a major area of work, with sheets consecutively numbered.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Formwork: See Section 031000.
- B. Reinforcement: See Section 032000.
- C. Welded Fabric: See Section 032000.
- D. Bar Supports: Section 032000.
- E. Portland Cement: A domestic brand approved by the Architect for color and conforming to the requirements of ASTM C150, low alkali, Type I or Type III.

- F. Fine Aggregate: Conform to ASTM C33 except that the fineness modules shall not be less than 2.1 nor more than 3.1 and the gradation shall be as specified herein below:

<u>Sieve No.</u>	3/8	#4	#8	#16	#30	#50	#100
Total % Passing (By Weight)	100	95-100	80-100	50-85	25-60	10-30	2-10

- G. Coarse Aggregate: Crushed stone or gravel and shall conform to ASTM C33. Size of coarse aggregate shall be as specified herein below:

1. Size #67: (3/4 inch to #4) – for Sections 4" thick and greater
2. Size #7: (1/2 inch to #4) – for Sections less than 4" thick

- H. Water used in mixing concrete shall be clean and fit to drink.

- I. Admixtures:

1. Air-entraining Admixtures: Conform to the requirements of ASTM C260 and shall contain no chloride. Air-entraining shall not be used for interior slabs receiving troweled finishes. Submit certification for approval.
2. Retarding Admixtures: Contain no chloride, shall be free of organic acids or salts of organic acids, shall be compatible with the air-entraining admixture to be used and shall conform to the requirements of ASTM C494, Type B. Submit certification for approval.
3. Water-Reducing Admixtures: Contain no chloride, shall be free of organic acids, or salts of organic acids, shall be compatible with the air-entraining admixture to be used and shall conform to the requirements of ASTM C494, Type A, water-reducing normal-setting admixture and, ASTM C494, Type D, water-reducing and retarding admixture. Submit certification for approval.
4. Water-Reducing, High Range (WRHR) Admixtures: Shall contain no chloride, shall be free of organic acids or salts of organic acids, shall be compatible with the air-entraining admixture to be used, and shall conform to the requirements of ASTM C494, Type F or G. Submit certification for approval.
5. High, early strength accelerating, water-reducing admixture: contains no chloride, shall be free of organic acids, shall be compatible with air-entraining admixtures to be used and shall conform to the requirements of ASTM C494, Type C or F. Submit certification for approval
6. Provide technical field service during initial pours at no cost to the Owner by one experienced in the adjustment of concrete mixes for the particular admixtures being used.

- J. Waterproof Curing Paper: Conform to ASTM C171

- K. Curing Compound: Contain no wax or varnish. Conform to ASTM C309, Type I, and Filor by West Chemical Products, Inc., Kure-N-Seal by Sonneborn-Contech, Inc., Clear Bond by Guardian Chemical Corp., Mr. Klear Seal by Castle Chemical Company, or Sealtight CS-309.
- L. Expansion Joint Material in the Building: Non-extruding and resilient non-bituminous type conforming to ASTM D1752, Type II.
- M. Dovetail Anchor Slots for Brick and Block Against Concrete: 1" x 1" 24 gage galvanized steel with drip type corrugated 16 gage galvanized steel anchors, Hohmann and Barnard, Inc., No. 305 with No. 303 anchor, Richmond Screw Anchor Co., Inc., No. 051F with 020 anchor, or Hackman Building Products No. 100 with No. 108 anchors.

2.2 PROPORTIONING

- A. Proportion ingredients for each class of concrete by weight when the slump is the maximum permitted to produce an average compressive strength at 28 days which exceeds the specified compressive strength in accordance with Chapter 5, Section 5.3 of the Building Code Requirements for Reinforced Concrete (ACI-318-95).
- B. Air content of freshly mixed, air-entrained concrete as determined by the method of ASTM C 173 shall be 5%. A field tolerance of 1%+ is acceptable. All exterior concrete, exposed to the weather, shall be air entrained. Interior concrete shall not be air entrained.
- C. Water-reducing admixture shall be used in all concrete to reduce the total water requirement per cubic yard of concrete without loss of workability, and produce an increased strength proportional to the water/cement ratio. During ambient temperatures of 75 F or below use normal setting, water-reducing admixture meeting ASTM C484, Type A. During ambient temperatures of 75 F and above use set-retarding, water-reducing admixture meeting ASTM C494, Type B and Type D. During ambient temperatures of 60 F and below use a high, early strength accelerating water-reducing admixture meeting ASTM C494, Type C and Type E.
- D. The mixes shall be designed to secure concrete having the following consistency range in slump:

<u>Type of Construction</u>	<u>Slump Range (Inches)</u>
Reinforcement Foundations	2-3
Elevated, Structural Slabs	2-4
Sidewalks, Driveways & Slabs-on-Grade	2-4

2.3 BATCHING AND MIXING

- A. Measure cement by weight on a scale separate from those used for other materials. Cement may be measured in bags of standard weight of 94 pounds; however, no fraction of a bag shall be used in any batch.
- B. Measure aggregates by weight. Batch weights shall be based on saturated surface dry materials corrected for the actual moisture condition of the aggregate.
- C. Measure water by volume or by weight by devices not subject to variation due to variable pressure in the water supply line. Measuring tanks shall be provided with means for checking their calibration.
- D. Devices for measuring quantities of cement, aggregates, water and admixtures shall be accurate within 1% under operating condition.
- E. Furnish delivery ticket for each batch of concrete before unloading at the site. Weights of fine and coarse aggregate, amount of cement, and total water as batches shall be printed on ticket by an automatic printing device or shall be recorded and initialed by an employee of the Contractor stationed at the batch plant. Delivery ticket shall, in addition, include the following:
 - 1. Name of batch plant.
 - 2. Serial number of ticket.
 - 3. Date and truck number.
 - 4. Name of contractor.
 - 5. Job name and location.
 - 6. Class of concrete and slump.
 - 7. Cubic yards of concrete.
 - 8. Time loaded.
 - 9. Amount water added at job.
 - 10. Initials of job superintendent.
- F. Ready-mixed concrete shall be produced and delivered in accordance with the requirements of ASTM C94.

PART 3 - EXECUTION

3.1 RESHORING

- A. Concrete elements shall not be permitted to deflect load during form stripping.
- B. After forms are removed, slabs, beams and girders over ten feet in span and cantilevers over four feet shall be reshored for the remainder of the 28-day period. Concrete elements shall not be permitted to deflect or accept load during reshoring operations.
- C. Reshoring operations shall be performed so that existing concrete members are not subject to overloads, eccentric loading, or reverse bending.
- D. Reshoring elements shall have the same capabilities as original shoring, and shall be wedged to provide solid bearing and support. Bracing shall be provided.

3.2 PLACING CONCRETE

- A. Give the Architect 48 hours advance notice before placing concrete in any portion of the structure to permit inspection of the forms and reinforcement. Embedded items of whatever nature shall be in place prior to inspection. An authorization of the Architect shall be secured before concrete is placed.
- B. Remove water and debris from forms before depositing concrete.
- C. Clean reinforcement and forms coated with foreign material or with concrete from previous placing operations before depositing concrete.
- D. Place concrete not later than 1-1/2 hours after mixing. Mix temperature shall not exceed 90 F at time of placing.
- E. Construction joints shall be keyed and bulkheaded vertically and located at the center of span.
- F. Internal type mechanical vibrators and hand spading shall be used to consolidate the concrete.
- G. Concrete shall not be placed within twenty-five feet of workmen placing or securing reinforcement.
- H. Place no concrete when the atmospheric temperature is below 35 F. After concrete has been placed, if the temperature drops below 35 F, conform to paragraph 3.06, Curing and Protection.

3.3 FINISHING FORMED SURFACES

- A. Rough form finish shall be confined to all concrete surfaces not exposed to public view. After removal of forms, tie holes and defects shall be patched. Fins exceeding 1/4" in height shall be chipped off or rubbed off. Otherwise, surfaces shall be left with the texture imparted by the forms.
- B. Smooth form finish shall be used for all concrete surfaces exposed to public view. Form facing material shall produce a smooth, hard, uniform texture on the concrete. Form material with raised grain, torn surfaces, worn edges, patches, or dents which will impair the textures of the concrete surface shall not be used. Tie holes and defects shall be patched. All fins shall be removed.

3.4 REPAIR OF DEFECTS

- A. Inspection by the Architect shall determine whether or not work is acceptable; and, if repairable, the method of repair to be used. Defects in materials and workmanship shall be subject to the above inspection at all times during the progress of the work regardless of previous inspections.
- B. Condemned work shall consist of any concrete work which cannot be repaired. Condemned work shall be removed and replaced, at the Contractor's expense, with work that will conform to the contract documents.
- C. Repair surface defects which are 1/2 inch or less in depth including tie holes by patching the same working day the forms are removed. Cut back defect at 90 degrees to the surface to sound concrete and at least 1" without feather edges. After soaking with water, pack a stiff mortar in the defect. In exposed concrete the mortar mix shall be determined by trial method using a mixture of white and grey portland cement to produce the described color. After mortar has attained its initial set, the patch shall be scraped or rubbed flush with the concrete and match the color and texture of the adjoining surface.

3.5 SLABS

- A. Edge forms and intermediate screed strips shall be set to produce the designated elevations and contours of the finished surface. As a minimum, maintain the concrete thicknesses shown on the drawings.
- B. Insure that termite treatment shall have been completed before installing vapor barrier. Install vapor barrier with 6" laps sealed with the manufacturer's recommended sealing compound.
- C. Place and consolidate to produce a surface within tolerances. Test for grade (or level) and correct by removing excess or adding and compacting additional concrete. These operations must be performed before bleeding water has an opportunity to collect on the surface.

- D. Where metal forms are used at joints, the edge of the form shall be flush with the surface of the concrete. Where saw-cut joints are specified herein, cutting shall be started as soon as the concrete has hardened to prevent aggregates being dislodged by the saw, and shall be completed before shrinkage stresses become sufficient to produce cracking.
- E. Scratched finish shall be applied to surfaces intended to receive bonded applied cementitious applications. Depress slabs as specified for applied finish. All pitches to drains shall be made in the concrete slab and not the setting bed. Level to a Class C tolerance and roughen surface with stiff brushes or rakes before final set. Before the concrete has fully hardened remove laitance and loose aggregate from the surface.
- F. Troweled finish shall be applied to floors intended as walking surfaces or to receive contact floor coverings. Surface shall first be float-finished as specified above. It shall next be power troweled, and finally hand troweled. Final troweling shall be complete when a ringing sound is produced as the trowel is moved over the surface. The finished surface shall be free of trowel marks, uniform in texture and appearance, and shall be planed to a Class A tolerance, except tolerance for concrete on metal deck shall be Class B. Any defects of sufficient magnitude to show through floor covering shall be removed by grinding or patching.
- G. Tolerance for finish surfaces shall be determined by a straight edge placed anywhere on the surface in any direction and shall be true planes within the following limitations:
 - 1. Class A – 1/8 inch in 10 feet;
 - 2. Class B – 1/4 inch in 10 feet;
 - 3. Class C – 1/4 inch in 2 feet;

3.6 CURING AND PROTECTION

- A. Immediately after placement, concrete shall be protected from premature drying, temperatures above or below the range recommended in ACI 305R, latest edition, and 306R, latest edition, and mechanical injury.
- B. Cure all surfaces for a period of 7 days and until average compressive strength has reached 70% of specified strength. Curing shall be by ponding, moist curing with sand or absorptive mats kept continuously wet, continuous application of steam (not exceeding 105 F) or mist spray, waterproof curing paper or liquid membrane forming curing compound. Selection of curing method shall be compatible with the finish to be applied to the concrete surface.
- C. Use curing compound directly from the container without dilution and apply not later than one hour after final finishing in one coat at a coverage not to exceed 200 S.F. per gallon for surfaces with a "floated" or "broom" finish, or 300 S.F. per gallon for surfaces with a "troweled" finish. Submit engineering testing laboratory certification for approval. Do not use curing compound on surfaces to receive mortar beds for tile work.

- D. Cold weather protection shall be in accordance with recommended practices of ACI 306R, latest edition. Whenever the mean daily outdoor temperature is less than 40 F, the temperature of the concrete shall be maintained between 50 F and 70 F for the curing period.
- E. Hot weather protection shall be in accordance with ACI 305R, latest edition. When the anticipated ambient air temperature exceeds 80 F during placing or finishing operations, a retarding admixture shall be used in the mix to retard the setting time of the concrete.

3.7

- A. Contractor shall submit to the Architect the concrete materials and the concrete mix designs proposed for use with a written request for review. Submittal shall include the results of all testing performed to qualify the materials and to establish the mix designs. Place no concrete in the work until mix design has been reviewed.
- B. Contractor shall sample, mould, initially cure, and transport to the laboratory the acceptance test specimens for testing. During the first 24 hours after molding he shall provide means for maintaining the temperature immediately adjacent to the specimens within the range of 60 F to 80 F and prevent loss of moisture from the specimens. After the initial curing period the acceptance test specimens shall be transported in a damp condition to the laboratory in a manner to prevent damage to the specimens. Include information for reporting of test data.
 - 1. Slump and air content shall be determined at the beginning of each day's pour and for each batch of concrete sampled for compressive strength tests. Make corrections to the mix if slump, unit weight, or air content are not within the specified tolerances. Slump and air content shall be determined by ASTM C143 and ASTM C173 respectively.
 - 2. Make sets of four acceptance cylinders for strength testing for each 50 yards of concrete or fraction thereof for each class and strength for each day's concreting which shall be molded from concrete samples taken at random over the duration of the pour.
 - 3. Samples of concrete for strength testing shall be representative of the concrete in-place in the structure and shall not be taken from the first one-third of the concrete of the ready-mix truck. **No water shall be added to the concrete after samples of concrete for strength testing have been secured.**
 - 4. Acceptance test cylinders shall be molded and cured in accordance with ASTM C31 from concrete samples in accordance with ASTM C172
 - 5. Provide designated testing laboratory with all field data specified to be included on concrete test reports in paragraph 3.08.
 - 6. Field sampling and testing shall be performed by ACI Certified Technicians.

3.8 LABORATORY DUTIES IN TESTING

- A. Designated testing laboratory shall perform all operations of testing materials, concrete and verifying mix designs.
- B. Concrete test reports shall include the following:
 - 1. Class and strength concrete.
 - 2. Slump.
 - 3. Air content.
 - 4. Temperature of concrete mix at time of placement.
 - 5. Date and time of molding.
 - 6. Date and age of test specimens.
 - 7. Location of concrete in the structure.
 - 8. Delivery ticket serial numbers.
- C. Furnish five (5) copies of all test reports to the Architect.
- D. Designated testing laboratory shall be selected by the Architect and paid by the Owner.

3.9 STRENGTH TESTING AND EVALUATION

- A. For each set of acceptance test cylinders, one cylinder shall be broken at the age of 7 days for information and two cylinders shall be broken at the age of 28 days for acceptance. The remaining cylinder shall be held by the laboratory for 120 days for use as a verification cylinder if required. Test in accordance with ASTM C39, latest edition.
- B. Concrete shall be considered "Questionable Concrete" where any of the following test evaluations occur:
 - 1. Individual test strength is more than 500 psi below specified strength; or
 - 2. Average of any three consecutive strength tests are less than specified strength; or
 - 3. Individual test strength is less than specified strength and the concrete represented by the test is for concrete for a "critical" area of the structure. Critical areas of the structure are those areas which, in the opinion of the Architect, are critical to the structural stability of the structure as a whole.

3.10 QUESTIONABLE CONCRETE

- A. Core tests shall be made at no cost to the government, and as directed by the Architect. If core tests fail to demonstrate the test strength required by the contract documents, or if they are impractical to obtain, and structural analysis does not confirm the safety of the structure, the Architect may, at his discretion, condemn the work or require load tests or additional construction. Should structural analysis confirm the safety of the structure, the Architect may, at his discretion, accept the questionable concrete in accordance with the Article of the General Conditions for the Acceptance of Defective Non-Conforming Work.
- B. The Contractor shall pay all costs incurred in providing the additional testing or analysis to resolve the acceptability of questionable concrete.
- C. The term "Building Official" in ACI Building Code 318 shall be deemed to mean, and does mean, the Architect.

3.11 CORE TESTS

- A. Three representative cores shall be taken from each member or area of concrete for each test considered "questionable". Location of cores shall be as directed by the Architect to least impair the strength of the structure. Damaged cores shall be replaced.
- B. Cores shall be obtained and tested in accordance with ASTM C42, latest edition except that if concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60 F to 80 F, and relative humidity less than 60%) for 7 days before test and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be immersed in water for at least 48 hours and tested wet.
- C. Concrete in the questionable area will be considered structurally acceptable if the average of the cores is equal to or greater than 90% of the specified strength and no single core is more than 500 psi below specified strength.

3.12 LOAD TESTS AND ADDITIONAL CONSTRUCTION

- A. Load tests shall be applied and their results evaluated in accordance with Chapter 20 of ACI Building Code 318, latest edition.
- B. Work judged inadequate by results of a load test shall be reinforced with additional construction if so directed by the Architect or shall be replaced.
- C. Additional construction and replaced work shall be at the Contractor's expense.

3.13 CONDUIT WORK

- A. Electrical conduits shall be buried in concrete slabs. Low conduit shall be wired to the upper side of bottom reinforcing and top conduit shall be wired to the lower side of top steel.
- B. Take care in spacing concrete around gangs or parallel conduit. Where such conduits occur, they shall be separated by at least one inch.

END OF SECTION 033000

SECTION 042100 - REINFORCED MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes grouted, reinforced masonry consisting of grout and reinforcing steel.
- B. Related Sections include the following:
 - 1. Division 03 Section "Concrete Reinforcement" for reinforcing steel.
 - 2. Division 03 Section "Cast-In-Place Concrete" for concrete.
 - 3. Division 04 Section "Unit Masonry" for all other elements of masonry construction.

1.3 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

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

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
 - 1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
 - 2. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.

3. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details Reinforcing Steel. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show bar schedules, bent bar diagrams and other arrangements as required for fabrication and placement. Show elevations of reinforced walls.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 1. Grout mixes complying with material and compressive strength requirements of ASTM C 476 for fine grout. Include description of type and proportions of grout ingredients and design slump.

1.7 QUALITY ASSURANCE

- A. Comply with the provisions of the following codes, specifications and standards, unless more stringent requirements are specified or shown on the Drawings. Reference is made to the edition in force at the time these specifications are issued.
 1. Florida Building Code, 2010 Edition.
 2. ACI 530/ASCE 5 "Building Code Requirements for Concrete Masonry Structures"
 3. ACI 530.1/ASCE 6 "Specifications for the Design and Construction of Load Bearing Concrete Masonry"

1.8 DELIVERY, STORAGE, AND HANDLING

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

elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

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

1.9 PROJECT CONDITIONS

- A. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Refer to Division 04 Section "Unit Masonry" for masonry materials and accessories and grout materials not included in this section.

2.2 CONCRETE MASONRY UNITS

- A. Regional Materials: Provide CMUs that have been manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi
 - 2. Density Classification: Normal weight.
- C. Provide special shapes where shown and as required for corners, jambs, sashes, control joints, lintels, bond beams and other special conditions.

2.3 GROUT MATERIALS

- A. Regional Materials: Provide aggregate for mortar and grout, cement, and lime that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- C. Hydrated Lime: ASTM C 207, Type S.

- D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- E. Masonry Cement: ASTM C 91.
- F. Aggregate for Grout: ASTM C 404 for fine grout.

2.4 REINFORCING STEEL

- A. Uncoated Steel Reinforcing Bars: ASTM A 615, Grade 60. Shop fabricate bent bars.
- B. Masonry Joint Reinforcement, General: ASTM A 951.
 - 1. Interior Walls: Mill- galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized, carbon, ASTM A 153 with a coating thickness of 1.50 oz/sf steel.
 - 3. Wire Size for Side Rods: 0.148-inch diameter.
 - 4. Wire Size for Cross Rods: 0.148-inch diameter.
 - 5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication.
 - 1. Provide units with either two loops or four loops as needed for number of bars indicated.

2.5 GROUT MIXES

- A. Grout for Unit Masonry: Comply with ASTM C 476 with a minimum compressive strength of 2500 psi in 28 days.
 - 1. Use fine grout with a slump of 8 to 10 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Verify that foundations are within tolerances specified.
 - 2. Verify that reinforcing dowels are properly placed.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Refer to Division 04 Section “Unit Masonry” for general installation requirements of unit masonry.
- B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units which are not in multiples of 8”. Install cut units with cut surfaces and, where possible, cut edges concealed.
- C. Allow wet masonry units to dry prior to placement.

3.3 CONSTRUCTION TOLERANCES

- A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, reinforcement, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern: Lay masonry in one-half running bond with vertical joint in each course centered on units in courses above and below, unless otherwise indicated on Drawings. Interlock each course at corners.
- C. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- D. Place clean units while the mortar is soft and plastic. Remove and relay in fresh mortar any unit disturbed to the extent that initial bond is broken after initial positioning.
- E. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- F. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- G. Design, provide and install bracing that will assure stability of masonry during construction. Include provisions to project against wind or other natural or construction

forces that might collapse or otherwise damage a partially or completely built masonry wall in a partially completed structure.

3.5 MORTAR BEDDING AND JOINTING

1. Lay hollow masonry units as follows: With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

3.6 MASONRY JOINT REINFORCEMENT

- A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch. Lap reinforcement a minimum of 6 inches.
 1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by using prefabricated “L” and “T” sections.
- D. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 16 inches are shown. Reinforce and grout lintels as shown on the Drawings.
 1. Provide precast lintels made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars indicated or required to support loads indicated. Cure precast lintels by the same method used for concrete masonry units.
 2. Provide prefabricated or built-in-place masonry lintels. Use specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

3. Provide either of above at Contractor's option or provide precast or formed-in-place concrete lintels complying with requirements in Division 03 Section "Cast-in-Place Concrete."
- B. Install steel lintels where indicated.
- C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.8 REINFORCED UNIT MASONRY INSTALLATION

- A. Laying Masonry Walls: Construct masonry walls as follows:
 1. Lay masonry units to top of grout pour prior to placing grout. Maximum grout pour height is 24' or top of bond beam, whichever is lower.
 2. Construct wall such that vertical cells to be grouted are aligned and unobstructed openings for grout are 3"x4" (minimum). Construct grout spaces free of mortar droppings, debris, loose aggregates, and any material deleterious to grout; or, clean the cells prior to grouting. Remove masonry protrusions extending 1/2" or more into cells to be grouted.
 3. Do not lay masonry until grouted masonry below is cured.
 4. In bond beams, use special units or modify regular units to allow placement of horizontal bars. Place small mesh, expanded metal lath or wire screening in mortar joints under bond beam courses over cells of non-reinforced vertical cells.
- B. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
 1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- C. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602 and as follows:
 1. Place reinforcement and accessories as indicated.
 2. Support and fasten reinforcement together to prevent displacement by construction loads or by placement of grout.
 3. Clean reinforcement by removing mud, oil, or other materials that will reduce the bond at the time grout is placed. Reinforcement with tightly bound rust and/or mill scale is acceptable without cleaning provided the dimensions and weights, including heights of deformations, of the cleaned sample are not reduced.
 4. Place all reinforcement prior to grouting. Tie vertical reinforcement to dowels at base of masonry with tie wire and thread masonry units over or around reinforcement. Support vertical reinforcement at 10'-0" o.c. Extend vertical bars

the specified lap length above top of pour and support bar in proper position at top of grout pour. Where vertical bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosen before mortar sets. After insertion of bar, pull loops and bar to proper position and tie free ends.

5. Do not bend reinforcement after it is embedded in grout.
6. Splice bars only where indicated. Provide 48 bar diameter lap splices, U.O.N. Place bars in contact and wire tie. Bars spliced by noncontact lap splices shall be spaced 6" apart (maximum).
7. Bar placement tolerance is $\pm 1/2$ " perpendicular to wall and 2" along wall. The clear distance between parallel bars that are not contact lap spliced shall be not less than 1" in walls and 1 1/2" in columns and pilasters. Maintain 1/4" clear between bars and any face of masonry.

D. Cleanouts: Provide cleanout openings at each vertical bar at the base of walls in which one of the following applies:

1. Grout pour height exceeds 5'.
2. Vertical bars are not otherwise fastened to prevent displacement. In this case, use cleanout to securely tie bar in position.
3. To remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from cell and top of support in cells to be grouted.

Construct cleanout by cutting opening in face shell. Construct cleanouts with openings of sufficient size to permit removal of debris and tying of bars. Minimum size is 3"x3". After cleaning and inspection, close cleanout opening and brace closure to resist grout pressure.

E. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602.
2. Place grout within 1 1/2 hours from introducing water in the mixture and prior to initial set.
3. Confine grout to the areas indicated.
4. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Architect.
5. Place grout continuously in lintels and bond beams. Grout walls in lifts not exceeding 5' or the elevation of top of bond beam, whichever is lower.
6. If grout pour during one day exceeds 5', grout in lifts 5' each or less, with not less than 30 minutes and not more than one hour between lifts.
7. Terminate grout 1 1/2" below bond beam course or where cell above is to be grouted.
8. Place grout in bond beam course before filling vertical cores above bond beam.
9. Consolidate grout with mechanical vibrators having a 3/4" diameter head. Grout pours 12" high or less may be puddled in lieu of mechanical vibration.

3.9 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- B. Testing Frequency: Four grout cubes will be sampled and tested for compressive strength per ASTM C 1019 for each 5000 ft.² of wall surface.

END OF SECTION 042100

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following net-area compressive strength of masonry of (f'_M) at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Table 1 and Table 2 in ACI 530.1/ASCE 6/TMS 602.
- B. Concrete Masonry Units: $f'_M = 1,500$ psi

1.2 HANDLING AND STORAGE

- A. Handle concrete masonry units to prevent chipping and breakage, and store on platforms to protect them from contact with the soil. Cover stored brick and block with waterproof coverings.
- B. Deliver, store and handle mortar materials to prevent deterioration, inclusion of foreign materials, damage of materials by water, or breakage. Packages or materials showing evidence of water or damage shall be rejected.
- C. Any material damaged in any way shall not be used for masonry work. Cement and lime shall be delivered and stored in the original, unbroken containers, marked as to manufacturer and brand.

1.3 QUALITY ASSURANCE

- A. Fire Performance Characteristics: Where indicated on the drawings, provide materials and construction which are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E 119-88 by a recognized testing and inspecting organization.
- B. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product specified herein for each continuous surface or visually related surfaces.
- C. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.
- D. Field Constructed Mock-Ups: Prior to installation of masonry work, erect sample wall panels in a location approved by the Architect to represent completed masonry work for qualities of

appearance, materials and construction; build mock-ups to comply with the following requirements:

1. Build mock-ups for exterior wall 6' long by 4' high by full thickness, including face and back-up wythes as well as accessories.
2. Retain mock-ups during construction as standard for judging completed masonry work. When directed by the Architect, demolish mock-ups and remove from site.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete Masonry Units: Conform to ASTM C90-85, Type N-II. Hollow lightweight, concrete masonry units of modular dimensions of size and shapes necessary to complete the work. Units shall be sound and free from cracks, chipped edges, and defects which would interfere with their setting or impair the strength or durability of the construction. Exposed Faces: Manufacturer's standard color and texture.
- B. Water: Clean and potable.
- C. Portland Cement: Conform to ASTM C150-89, Type II. Cement used throughout the project shall not vary in color.
- D. Masonry Cement: Conforms to ASTM C91-89, Type M, S, or N.
- E. Sand for Masonry Work: Conform to ASTM C144-87, of color matching approved sample.
- F. Joint Reinforcement: Have 8 gauge side bars conforming to ASTM A82-88 and 9 gauge cross bars, formed to truss design, with side bars and cross bars galvanized. Reinforcement shall be of width to extend to within 1" of the faces of the walls equal to Dur-O-Eye with 3/16" diameter Dur-O-Wall adjustable wall tie eye sections welded at 16" centers.
- G. Wall Ties for Brick: Rectangular adjustable wall ties mated to CMU eye sections and provisions for securing reinforcing bar in brick (Seismic reinforcing).
- H. Wire Mesh Ties: Galvanized hardware cloth, 19 gauge, 1/2" mesh, 3" minimum width.
- I. Miscellaneous Masonry Accessories
 1. Premolded Control Joint Strips: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated on the drawings. Styrene-butadiene rubber compound.
- J. Masonry Grout: Use grout conforming to ASTM C476 and the Structural Notes on Sheet S0.1 of the structural drawings.
- K. Vertical reinforcement: See Section 032000.

L. Reinforcing Bar Positioners

1. Horizontal Bars: Dur-O-Wal D/A 811; nine gauge basic bright finish steel wire meeting ASTM A82-01.
2. Vertical Bars: Dur-O-Wal D/A 810; nine gauge basic bright finish steel wire meeting ASTM A82-01.

2.2 MORTAR AND GROUT MIXES

- A. General: Do not add admixtures including coloring pigments, air entraining agents, accelerators, retarders, water repellent agents, anti-freeze compounds or admixtures, unless otherwise indicated on the drawings. Do not use calcium chloride in mortar or grout.
- B. Mortar Color: Mortar shall be colored to match colors on existing build-up.
- C. Mixing: Combine and mix cementitious materials, water, and aggregates in mechanical batch mixer; comply with referenced ASTM standards for mixing times and water content.
- D. Mortar for Unit Masonry: Comply with ASTM C 270-88a, Proportion Specification, for types of mortar specified, unless otherwise indicated on the drawings.
 1. Use Type M mortar for masonry below grade and in contact with earth, and where indicated on the drawings.
 2. Use Type M or S mortar for load bearing exterior and interior load bearing walls.
 3. Use Type N mortar for interior non-load bearing walls and other applications where another type is not indicated on the drawings.
- E. Grout for Unit Masonry: Use concrete grout as indicated on structural drawings.
 1. The quantities of cementitious materials shall be adjusted to maintain the specified strength.

2.3 MIXING MORTARS

- A. Mortars shall be machine mixed in mixer in which water quantity can be controlled. For work requiring only small mortar or grout batches, mortar may be hand mixed.
- B. Mixing time shall be at least 5 minutes, 2 minutes which shall be devoted to mixing dry materials and 3 minutes for continuing mixing after addition of water. Use no mortars that have stood more than one and one-half hours.
- C. Where dry mix method is used, rake wall; turn over materials for each batch before adding water until even color of mixed materials indicates that cementitious material has been distributed throughout mass, after which add water in increments until mixed mortar of workable plasticity is obtained.

- D. Pointing mortar shall be of dry consistency as will produce mortar sufficiently plastic to be worked into masonry joints.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. Work of other trades shall be installed and tested before enclosing such work with masonry.
- B. Build-in horizontal masonry reinforcement at 8" on center vertically below grade and 16" on center vertically above grade. Joint reinforcement shall be continuous, lapped not less than 6" at splices, with corners cut and bent to insure continuity. Joint reinforcement shall not pass through vertical control joints. At corners where joint reinforcement does not occur in the same course in two abutting walls, carry joint reinforcement from each wall around the corner not less than three feet into abutting wall.
- C. Examine drawings to determine requirements for accommodation of work of other trades and provide recesses, chases, reglets, slots for such work; patch around same.
- D. In cold weather, when the outside temperature is below 40F, the temperature of the masonry when laid shall be above 40F and maintained on both sides of the masonry wall for at least 72 hours.
- E. Make provisions to prevent damage from wind.
- F. Keep masonry dry until capped by construction details. Cover tops of all walls and other masonry when stopping work for the day and protect them at all times from rain with weighted canvas or 6 mil polyethylene film covers.
- G. Provide cutting and patching to accomplish the indicated work and to accommodate the work for others. Patching shall match adjoining work in pattern and texture. Masonry saws shall be used for cutting masonry units.

3.2 BLOCK MASONRY

- A. Concrete masonry units shall be of sizes shown on the drawings, laid up plumb and true to line, and with cells vertical. Interior exposed concrete masonry units shall be laid up in running bond.
- B. The first course of block shall be laid on a full bed of mortar after the concrete slab has been cleaned and dampened. Except at cells containing reinforcing rods, fill cells of the first course solid with mortar.
- C. Work shall be anchored and bonded as specified above.
- D. The vertical mortar joint at wall intersections shall be raked out to a depth of 1" on both faces, caulked per Section 079200 - Caulking.

- E. Voids in concrete masonry units containing reinforcing rods, and at locations shown on the drawings, shall be filled with 3,000 psi grout as indicated on structural drawings.
- F. One block and one join shall equal 8".
- G. Joints shall be of uniform thickness, and where exposed shall be flush.
- H. Build rated walls per UL U905.

3.3 CONSTRUCTION TOLERANCES

- A. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4" in any bay or 20' maximum, nor 1/2" in 40' or more. For top surface of bearing walls do not exceed 1/8" between adjacent floor elements in 10' or 1/16" within width of a single unit.
- B. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls and partitions, do not exceed 1/2" in any bay or 20' maximum, nor 3/4" in 40' or more.
- C. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4" nor plus 1/2".
- D. Variation in Mortar Joint Thickness: Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8".

3.4 LAYING MASONRY WALLS

- A. Layout walls in advance for specified spacing of surface bond patterns with uniform joint widths and to locate openings, movement-type joints, returns and offsets. Do not use less-than-half-size units at corners, jambs and wherever possible at other locations.
- B. Lay-up walls to comply with specified construction tolerances, with courses spaced and coordinated with other work.
- C. Stopping and Resuming Work: Rack back 1/2-unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly and remove loose masonry units and mortar prior to laying fresh masonry.
- D. Built-In Work: As the work progresses, build-in items specified under this and other sections of these specifications. Fill in with masonry around built-in items.
 - 1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

2. Where build-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
3. Fill cores in hollow concrete masonry units with grout 3 courses (24") under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated on drawings.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- B. Maintain joint widths shown, except for minor variations to maintain bond alignment. If not shown, lay walls with 3/8" joints.
- C. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials.
- D. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units which have been set in position. For adjustments, remove units, clean off mortar and reset in fresh mortar.

3.6 VERTICAL REINFORCING

- A. All vertical reinforcing shall be installed at the centerline of the wall (or at the locations indicated) with a tolerance of plus or minus 1/2 inch lateral to the wall centerline.
- B. **Reinforcing Bar positioners shall be used for all vertical reinforcing.**
 1. Provide two per 5 foot lift but not less than two per each length of spliced reinforcing bar.
 2. Horizontal Type: Install in accordance with ACI Committee 530 Code Recommendations.
 3. Vertical Type: Install U-block or lintel block in accordance with Code requirements.

3.7 GROUTING

- A. All grouting of masonry shall be installed in five foot lifts with each lift being grouted before laying masonry units for next lift.
- B. Grouted masonry shall be constructed in such a manner that all elements of the masonry act together as a structural element.

- C. Prior to grouting, the grout space shall be clean so that all spaces to be filled with grout do not contain mortar projections greater than 1/2 inch, mortar droppings or other foreign material. Grout shall be placed so that all spaces designated to be grouted shall be filled with grout and the grout shall be confined to those specific spaces.
- D. Grout materials and water content shall be controlled to provide adequate fluidity for placement without segregation of the constituents, and shall be mixed thoroughly.
- E. The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour.
- F. Between grout pours, a horizontal construction joint shall be formed by stopping all wythes at the same elevation and with the grout stopping a minimum of 1½ inches below a mortar joint, except at top of wall. Where bond beams occur, stop grout pour a minimum of 1/2 inch below the top of the masonry.
- G. All cells and spaces containing reinforcing bars shall be filled with grout. Otherwise, grout masonry indicated on drawings.

3.8 HORIZONTAL JOINT REINFORCEMENT

- A. General: Provide continuous horizontal joint reinforcement in alternate courses of each wythe of all concrete masonry, including 4" veneer. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls, 1/2" elsewhere. Lap reinforcing a minimum of 6".
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated on drawings.
- C. Reinforce each wythe of all walls with continuous horizontal joint reinforcing unless noted to be omitted on drawings.
- D. Provide continuity at corners by use of prefabricated "L" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions. Space continuous horizontal reinforcement.
- E. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcement placed in 2 horizontal joints 8" apart, above the lintel and below the sill. Extend reinforcement a minimum of 2'-0" beyond jambs of the opening except at control joints. In load bearing wall, provide additional reinforcing as indicated on the structural drawings.

3.9 CONTROL AND EXPANSION JOINTS

- A. General: Provide vertical and horizontal expansion, control and isolation joints in masonry where shown on the drawings. Build-in related items as the masonry work progresses.
- B. Build-in non-metallic joint fillers where indicated on the drawings.

3.10 LINTELS

- A. Install steel and masonry lintels where indicated and as scheduled on the drawings.
- B. Provide masonry lintels where shown in the drawings, and wherever openings of more than 1'-0" for brick size units and 2'-0" for block size units are shown without structural steel or other supporting lintels. Provide formed-in-place masonry lintels. Support formed-in-place lintels. For hollow concrete masonry unit walls, use formed U-shaped lintel units with reinforcement bars placed as shown on the drawings, filled with coarse grout.
- C. Provide minimum bearing of 8" at each jamb, unless otherwise indicated on drawings.

3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and fill with mortar. Point-up all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants.
- C. 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 non-metallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Clean standard concrete unit masonry to comply with masonry manufacturer's directions and applicable NCMA "Tek" bulletins.
- D. Protection: Provide final protection and maintain conditions in the manner acceptable to Installer, which ensures unit masonry work being without damage and deterioration at time of Final Certificate of the Architect.

END OF SECTION 042200

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Types of cold-formed metal framing units include the following:
 - 1. Non-Load-bearing studs. (Exterior where shown and called for).
 - 2. Elevated floor joists
 - 3. Load bearing studs

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
 - 1. Product data and installation instructions for each item of cold-formed metal framing and accessories.
 - 2. Shop drawings for special components and installations not fully dimensioned or detailed in manufacturer's product data.
 - 3. Include placing drawings for framing members showing size and gage designations, number, type, location, and spacing. Indicate supplemental strapping, bracing, splices, bridging, accessories, and details required for proper installation.

1.4 QUALITY ASSURANCE

- A. Component Design: Calculate structural properties of studs and joists in accordance with American Iron and Steel Institute (AISI) "Specification for Design of Cold-Formed Steel Structural Members."

- B. Welding: Use qualified welders and comply with American Welding Society (AWS) D1.3, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 METAL FRAMING

- A. System Components: Manufacturers' standard load-bearing steel studs, size, shape, and gage as indicated. With each type of metal framing required, provide manufacturer's standard, steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories for applications indicated, as needed to provide a complete metal framing system.
- B. Materials and Finishes: (See Plans For Size) (Minimum 16" O.C. spacing.)
- C. For 16-gage and heavier units, fabricate metal framing components of structural quality steel sheet with a minimum yield point of 40,000 psi; ASTM A 446, A 570, or A 611.
- D. For 18-gage and lighter units, fabricate metal framing components of commercial quality steel sheet with a minimum yield point of 33,000 psi; ASTM A 446, A 570, or A 611.
- E. Provide galvanized finish to metal framing components complying with ASTM A 525 for minimum G 60 coating, exterior units only, others to be manufacturer's standard moisture resistant units.
- F. Finish of installation accessories to match that of main framing components, unless otherwise indicated.
- G. Fasteners: Provide nuts, bolts, washers, screws, and other fasteners with corrosion-resistant plated finish.
- H. Electrodes for Welding: Comply with AWS Code and as recommended by stud manufacturer.
- I. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

2.2 FABRICATION

- A. General: Framing components may be prefabricated into assemblies before erection. Fabricate panels plumb, square, true to line, and braced against racking with joints welded. Perform lifting of prefabricated units to prevent damage or distortion.
- B. Fabricate units in jig templates to hold members in proper alignment and position and to assure consistent component placement.
- C. Fastenings: Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer.

- D. Wire tying of framing components is not permitted.
- E. Fabrication Tolerances: Fabricate units to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations.
- B. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24 inches o.c. spacing for nail or power-driven fasteners or 16 inches o.c. for other types of attachment. Provide fasteners at corners and ends of tracks.
- C. Installation of Wall Studs: Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges.
- D. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- E. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.
- F. Install supplementary framing, blocking, and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.
- G. Frame wall openings larger than 2 feet square with double stud at each jamb of frame except where more than two are either shown or indicated in manufacturer's instructions. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure stud system wall opening frame in manner indicated.
- H. Install horizontal stiffeners in stud system, spaced (vertical distance) at not more than 54 inches o.c. Weld at each intersection.
- I. Erection Tolerances: Bolt or weld wall panels (at both horizontal and vertical junctures) to produce flush, even, true-to-line joints.

- J. Field Painting: Touch-up damaged shop-applied protective coatings. Use compatible primer for prime-coated surfaces; use galvanizing repair system for galvanized surfaces.

END OF SECTION 054000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Rooftop equipment bases and support curbs.
4. Wood blocking and nailers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

1.3 INFORMATIONAL SUBMITTALS

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.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Power-driven fasteners.
5. Powder-actuated fasteners.
6. Expansion anchors.
7. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship for the following:
 - 1. Dimension lumber framing.
 - 2. Parallel-strand lumber.
 - 3. Prefabricated wood I-joists.
 - 4. Rim boards.
 - 5. Miscellaneous lumber.
- B. Wall Framing
 - 1. All exterior wall framing, unless noted otherwise, shall be TimberStrand LSL manufactured by Trus Joist Weyerhaeuser or approved alternative
 - 2. All LSL framing shall have a minimum Modulus of Elasticity of 1.3x10⁶ psi.
 - 3. All LSL in contact with concrete shall be treated with StandGuard zinc borate.
- C. Roof Framing
 - 1. All primary roof members shall be Trus Joist manufactured by Weyerhaeuser or approved alternative
- D. 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. Provide dressed lumber, S4S, unless otherwise indicated.
- E. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- 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.

2.3 PLYWOOD BACKING PANELS

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

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Power-Driven Fasteners: NES NER-272.
- C. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.5 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate

nailers, blocking, and similar supports to comply with requirements for attaching other construction.

- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- D. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Shear Wall Panels: Install shear wall panels to comply with manufacturer's written instructions.
- F. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- G. Do not splice structural members between supports unless otherwise indicated.
- H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in FBC's International Building Code.
 - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in FBC's International Residential Code for One- and Two-Family Dwellings.

3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- 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 061000

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

1PART - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. Wood blocking, cants, and nailers.

1.3 DEFINITIONS

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

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

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

1.4 SUBMITTALS

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

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

Concord School Renovations

Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments specified to be High-Temperature (HT) type include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.
6. Metal framing anchors.

1.5 QUALITY ASSURANCE

A. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":

1. Miscellaneous lumber.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

2PART - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

MISCELLANEOUS ROUGH CARPENTRY	061053 - 2
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A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. 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.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPAC2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPAC31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

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

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

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

MISCELLANEOUS ROUGH CARPENTRY	061053 - 3
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Concord School Renovations

A. General: Comply with performance requirements in AWPAC20 (lumber) and AWPAC27 (plywood).

1. Use treatment that does not promote corrosion of metal fasteners.
2. Use Exterior type for exterior locations and where indicated.
3. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
4. Use Interior Type A, unless otherwise indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

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

C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

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

1. All Concealed blocking.

2.4 DIMENSION LUMBER FRAMING

A. Maximum Moisture Content: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness.

B. Other Framing: No. 2 grade and any of the following species:

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

2.5 MISCELLANEOUS LUMBER

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

MISCELLANEOUS ROUGH CARPENTRY	061053 - 4
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1. Nailers.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 15 percent maximum moisture content and any of the following species:

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

C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

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

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.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 FASTENERS

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

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

Concord School Renovations

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

H. 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.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

3PART - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- E. Do not splice structural members between supports, unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

G. 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.

H. Comply with AWP A 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.

I. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.
4. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
5. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.

J. 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.

3.2 WOOD GROUND, SLEEPER, 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.

Concord School Renovations

- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 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 wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

SECTION 061600 – SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

Section Includes:

- Wall sheathing.
- 1. Roof sheathing.

1.2 ACTION SUBMITTALS

Product Data: For each type of process and factory-fabricated product.

PART 2 - PRODUCTS

2.1 WALL SHEATHING

Plywood Sheathing: DOC PS 1, Exterior, Structural I sheathing.

2.2 ROOF SHEATHING

Plywood Sheathing: DOC PS 1, Exterior, Structural I sheathing., see structural notes

2.3 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
- B. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM AASTM A 153/A 153M.
 - 1. For roof and wall sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

- C. Securely attach to substrate by fastening as indicated, complying with the following:

Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.

1. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
2. ICC-ES evaluation report for fastener.

- D. Provide one H-clip at midspan of each span of all unsupported panel edge.
- E. 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.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 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:

Wall and Roof Sheathing:

Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.

- a. Screw to cold-formed metal framing.
- b. Space panels 1/8 inch apart at edges and ends.

END OF SECTION 061600

SECTION 061753 - SHOP-FABRICATED METAL TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal roof trusses.
 - 2. Metal girder trusses.

1.2 ACTION SUBMITTALS

- A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.
- B. Shop Drawings: 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, and gauges.
 - 3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
 - 4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
 - 5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
 - 6. Show splice details and bearing details.
- C. Delegated-Design Submittal: For metal-plate-connected metal 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.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For metal-plate-connected metal trusses, signed by officer of truss-fabricating firm.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Metal-plate connectors.
 - 2. Metal truss accessories.

1.4 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 Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Metal Trusses."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected metal trusses.

B. Structural Performance: Metal-plate-connected metal trusses shall be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1.

C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.

D. Metal Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Metal Construction" and its "Supplement."

2.2 METAL CONNECTOR PLATES

A. General: Fabricate connector plates to comply with TPI 1.

B. Hot-Dip Galvanized-Steel Sheet: ASTM A 653/A 653M; 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.

2.3 FASTENERS

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

1. 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, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

2.4 METAL FRAMING ANCHORS AND ACCESSORIES

- A. Allowable design loads, as published by manufacturer, shall comply with 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. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

2.5 FABRICATION

- A. 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 metal trusses within manufacturing tolerances in TPI 1.
- B. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of metal members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install metal 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. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- F. Securely connect each truss ply required for forming built-up girder trusses.
- G. 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 and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- H. Install metal trusses within installation tolerances in TPI 1.
- I. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

- J. Replace metal trusses that are damaged or do not comply with requirements.

END OF SECTION 061753

SECTION 062013 - EXTERIOR FINISH CARPENTRY – AS REQUIRED

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Exterior wood trim.
 - 2. Fiber Cement siding, trim and panels

- B. Related Requirements:

- 1. Section 061053 "Miscellaneous Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.

1.3 ACTION SUBMITTALS

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

- 1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

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

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

- D. Samples for Verification:

- 1. For each species and cut of lumber and panel products, with half of exposed surface finished; 50 sq. in. (300 sq. cm) for lumber and 8 by 10 inches (200 by 250 mm) for panels.
 - 2. For hardboard siding, 50 sq. in. (300 sq. cm) for board types and 8 by 10 inches (200 by 250 mm) for panels.

1.4 INFORMATIONAL SUBMITTALS

A. Compliance Certificates:

1. For lumber that is not marked with grade stamp.
2. For preservative-treated wood that is not marked with treatment-quality mark.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.

C. Sample Warranties: For manufacturer's warranties.

1.5 QUALITY ASSURANCE

1.6 DELIVERY, STORAGE, AND HANDLING

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

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

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

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

1.8 WARRANTY

A. Manufacturer's Warranty for Hardboard Siding Soffits and: Manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, deformation or deterioration beyond normal weathering.
2. Warranty Period for Factory-Applied Finish: Five years from date of Substantial Completion.
3. Warranty Period for Siding Trim (Excluding Finish): 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.
 - 2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.
- B. Softwood Plywood: DOC PS 1.
- C. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC3a.
 - 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
 - 2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
 - 4. Do not use material that is warped or does not comply with requirements for untreated material.
 - 5. Mark lumber with treatment-quality mark of an inspection agency approved by the ALSC's Board of Review.
 - a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

2.2 EXTERIOR TRIM

- A. Lumber Trim for Painted Finish match existing trim:
 - 1. Species and Grade: Redwood; RIS Clear.
 - 2. Species and Grade: Western red cedar; NLGA, WCLIB, or WWP A Grade A.
 - 3. Species and Grade: Hem-fir; NLGA, WCLIB, or WWP A 1 Common.
 - 4. Species and Grade: Eastern white pine, eastern hemlock-balsam fir-tamarack, eastern spruce, or white woods; NeLMA, NLGA, WCLIB, or WWP A Finish or 1 Common (Colonial).
 - 5. Species and Grade: Northern white cedar; NeLMA or NLGA 1 Common.
 - 6. Maximum Moisture Content: 19 percent with at least 85 percent of shipment at 12 percent or less.

7. Finger Jointing: Not allowed.
 8. Face Surface: Surfaced (smooth).
 9. Factory Priming: Factory coated on both faces and all edges, with exterior primer compatible with topcoats specified.
- B. Moldings for Painted Finish: MMPA WM 4, P-grade wood moldings, made from kiln-dried stock to patterns included in MMPA's "WM/Series Softwood Moulding Patterns."
1. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
 2. Finger Jointing: Not allowed.
 3. Factory Priming: Factory coated on both faces and all edges, with exterior primer compatible with topcoats specified.
 4. Brick-Mold Pattern: WWMPA WM 180, 1-1/4 by 2 inches (32 by 51 mm).
 5. Drip-Cap Pattern: WWMPA WM 197, 11/16 by 1-5/8 inches (17 by 41 mm).
 6. Bed-Mold Pattern: WWMPA WM 75, 9/16 by 1-5/8 inches (14 by 41 mm).
 7. Screen-Bead Pattern: WWMPA WM 144, 1/4 by 3/4 inch (6 by 19 mm).
- C. Primed fiber cement Trim: ANSI A135.6, primed with manufacturer's standard exterior primer. Recommended by manufacturer for exterior use.

2.3 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.
1. For face-fastening siding, provide ringed-shank siding nails or hot-dip galvanized-steel siding nails.
 2. For redwood, provide stainless steel fasteners.
 3. For prefinished items, provide matching prefinished aluminum fasteners where face fastening is required.
 4. For pressure-preservative-treated wood, provide hot-dip galvanized-steel fasteners.
 5. For applications not otherwise indicated, provide hot-dip galvanized-steel fasteners.
- B. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.
- C. Flashing: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.
1. Horizontal Joint Flashing for Panel Siding: Preformed, prefinished-aluminum, Z-shaped flashing.
- D. Continuous Soffit Vents: Fiber Cement soffit
1. Finish: paint.

- E. Sealants: Latex, complying with ASTM C 834 Type OP, Grade NF and applicable requirements in Section 079200 "Joint Sealants," and recommended by sealant and substrate manufacturers for intended application.

2.4 FABRICATION

- A. Back out or kerf backs of standing and running trim wider than 5 inches (125 mm), except members with ends exposed in finished work.
- B. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius and edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius.

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 the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed.
 - 1. Cut to required lengths and prime ends.
 - 2. Comply with requirements in Section 099113 "Exterior Painting."

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
 - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.
- B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials.
 - 1. Use concealed shims where necessary for alignment.
 - 2. Scribe and cut exterior finish carpentry to fit adjoining work.
 - 3. Refinish and seal cuts as recommended by manufacturer.

4. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
5. Coordinate exterior finish carpentry with materials and systems in or adjacent to it.
6. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install flat-grain lumber with bark side exposed to weather.
- B. Install fiber cement trim to comply with manufacturer's written instructions.
- C. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long, except where necessary.
 1. Use scarf joints for end-to-end joints.
 2. Stagger end joints in adjacent and related members.
- D. Fit exterior joints to exclude water.
 1. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint.
 2. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
- E. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 1. Butt joints only over framing or blocking, nailing top and bottom on each side and staggering joints in subsequent courses.
 2. Install prefabricated outside corners as recommended by manufacturer of siding materials.

3.5 ADJUSTING

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

3.6 CLEANING

- A. Clean exterior finish carpentry on exposed and semiexposed surfaces.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.

3.7 PROTECTION

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

END OF SECTION 062013

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

1PART - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. Plastic laminate cabinets.
2. Solid-surfacing-material countertops, integral sink, backsplashes, window stools.
3. Quality agglomerate countertops and backsplashes.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

- A. Product Data: For high-pressure decorative laminate, solid-surfacing material, plywood panels and trim, cabinet hardware and accessories.

1. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

- 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 devices and other items installed in plywood panels.
4. Show veneer panels with dimensions, grain direction and exposed face.

- C. Samples for Initial Selection:

1. Plastic laminates.
2. Wood veneer panels.
3. Thermoset decorative panels.
4. Solid-surfacing materials.

D. Samples for Verification:

1. For each species and cut of lumber and panel products with nonfactory-applied finish, with ½ of exposed surface finished, 50 sq. in. (300 sq. cm) for lumber and 8 by 10 inches (203 by 250 mm) for panels.
2. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish.
3. Wood veneer panel with finish, 8 by 10 inches (200 by 250 mm), for each color, pattern, and surface finish, with wood edge banding on 1 edge.
4. Thermoset decorative-panels, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with edge banding on 1 edge.
5. Solid-surfacing materials, 6 inches (150 mm) square.
6. Exposed cabinet hardware and accessories, one unit for each type.

E. Qualification Data: For Installer and fabricator.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a member of AWI.

B. Installer Qualifications: Fabricator of products.

C. Mock-up: Build mockups of plywood panels to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Material Completion.

D. 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.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

B. 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.

1.7 PROJECT CONDITIONS

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

1.8 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.

2PART - PRODUCTS

2.1 MATERIALS, GENERAL

- 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.
- B. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by the American Lumber Standards' Committee Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
 - 2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.
- C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
- D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
 - 1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following including premium grades:

- a. Abet Laminati, Inc.
- b. Formica Corporation.
- c. Lamin-Art, Inc.
- d. Nevamar Company, LLC; Decorative Products Div.
- e. Westinghouse Electric Corp.; Specialty Products Div.
- f. Wilsonart International; Div. of Premark International, Inc.
- 2. Colors and Patterns: Match Architect's samples.

2.2 QUARTZ AGGLOMERATE COUNTERTOPS

A. Configuration: Provide countertops with the following front and backsplash style:

- 1. Front: Straight, slightly eased at top.
- 2. Backsplash: Straight, slightly eased at corner.
- 3. Endsplash: Matching backsplash.

B. Countertops: 3/4-inch-(19-mm-) thick, quartz agglomerate with front edge built up with same material.

C. Backsplashes: 3/4-inch-(19-mm-) thick, quartz agglomerate.

D. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

2.3 COUNTERTOP AND WINDOW SILL MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cambria
 - b. Cosentino USA.
 - c. E.I. du Pont de Nemours and Company. - Basis of design Corian Zodiaq.
 - d. LG Chemical, Ltd.
 - e. Meganite Inc.
 - f. Samsung Chemical USA, Inc.
 - g. Technistone USA, Inc.
 - h. Transolid, Inc.

2. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.4 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

B.

Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.

C. Back-Mounted Pulls: BHMA A156.9, B02011, solid steel:

1. Hafele, #117.31.650, 8.8 inches (221mm) in nickel-plated matte finish.
2. Doug Mocket #DP7D 8 7/8" satin nickel.

D. Catches: Magnetic catches, BHMA A156.9, B03141.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

F. Shelf Rests: BHMA A156.9, B04013; metal.

G. Drawer Slides: BHMA A156.9, B05091.

1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches (150 mm) high and 24 inches (600 mm) wide.
3. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches (150 mm) high or 24 inches (600 mm) wide.
4. Trash Bin Slides: Hafele Double Waste Bin, US Cargo #502.74.252 (Accuride Overtravel slides), Provide the waste bins as part of this assembly.

H. Door Locks: BHMA A156.11, E07121.

I. Drawer Locks: BHMA A156.11, E07041.

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.
2. Satin Stainless Steel: BHMA 630.

K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Fasteners for Plywood Panels: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

C. 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.

D.

Adhesives, General: Do not use adhesives that contain urea formaldehyde.

E. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Contact Adhesive: 250 g/L.

F. Adhesive for Bonding Plastic Laminate: Contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.6 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 specified inspection agencies and with manufacturer's written recommendations for moisture content of finish carpentry at relative humidity conditions existing during time of fabrication and in installation areas.

C. Back out or kerf backs of the following members, except members with ends exposed in finish work:

1. Interior standing and running trim.

D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).

E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1.

Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

2.7 SOLID-SURFACING-MATERIAL COUNTERTOPS, BACKSPLASHES AND WINDOW STOOLS.

A. Grade: Custom.

B. Solid-Surfacing-Material Thickness: 2 CM.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:

1. Match Architect's sample and as selected by Architect from manufacturer's full range, all cost levels.

D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with shop-applied edges of materials and configuration indicated.

2. Fabricate tops with loose backsplashes for field application.

E. Install integral sink bowls in countertops in shop.

F. Drill holes in countertops for plumbing fittings in shop.

G. Fabricate window stools in shape as shown on the drawings.

3PART - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installation, condition woodwork to average prevailing humidity conditions in installation areas for a minimum of 24 hours, unless longer conditioning is recommended by manufacturer.

C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.3 INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
 - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.
- C. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
 - 2. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
 - 3. Coordinate finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate finish carpentry.
- D. Assemble 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.
- E. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
- F. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- G. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation.
- H. Install grommets in locations as indicated on the drawings and as directed by the Architect.

3.4 CABINETS

- A. 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 (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with toggle bolts through metal backing or metal framing behind wall finish.

3.5 COUNTERTOPS

- A. 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. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
 3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
 4. Caulk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."
- B. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.6 ADJUSTING AND CLEANING

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

END OF SECTION 064023

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Modified bituminous sheet waterproofing.
2. Bonded HDPE or polyethylene sheet waterproofing.

1.3 PREINSTALLATION MEETINGS

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

1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.4 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

- C. Samples: For each exposed product and for each color and texture specified, including the following products:

1. 8-by-8-inch (200-by-200-mm) square of waterproofing and flashing sheet.
2. 8-by-8-inch (200-by-200-mm) square of insulation.
3. 4-by-4-inch (100-by-100-mm) square of drainage panel.

4. Paver pedestal assembly.

1.5 INFORMATIONAL SUBMITTALS

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

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
 1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatment, corner treatment, and protection.
 - a. Size: 100 sq. ft. (9.3 sq. m) in area.
 - b. Description: Each type of wall installation.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

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

1.8 WARRANTY

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

- B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.
 - 1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pavers on plaza decks.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

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

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include.
 - a. American Hydrotech, Inc.; VM75.
 - b. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
 - c. CETCO Building Materials Group, a subsidiary of AMCOL International Corp.; Envirosheet.
 - d. Grace, W. R., & Co. - Conn.; Bituthene 3000/Low Temperature or Bituthene 4000.
 - e. Henry Company; Blueskin WP 100/200.
 - f. Meadows, W. R., Inc.; SealTight Mel-Rol.
 - g. Nervastral, Inc.; BITU-MEM.
 - h. Polyguard Products, Inc.; Polyguard 650.
 - i. Protecto Wrap Company; PW 100/60.
 - j. Tamko Building Products, Inc.; TW-60.
 - k. York Manufacturing, Inc.; HydroGard.
 - 2. Physical Properties:
 - a. Tensile Strength, Membrane: 250 psi (1.7 MPa) minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D 1970.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836.
 - e. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E 154.
 - f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.

- g. Water Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m) maximum; ASTM E 96/E 96M, Water Method.
- h. Hydrostatic-Head Resistance: 200 feet (60 m) minimum; ASTM D 5385.

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne primer recommended for substrate by sheet-waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick, predrilled at 9-inch (229-mm) centers.
- G. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
 - 1. Thickness: 1/4 inch (6 mm), nominal.
 - 2. Thickness: 1/8 inch (3 mm), nominal, for vertical applications; 1/4 inch (6 mm), nominal, elsewhere.
 - 3. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for protection course type.
- H. Protection Course: Fan folded, with a core of extruded-polystyrene board insulation faced on one side or both sides with plastic film, nominal thickness 1/4 inch (6 mm), with compressive strength of not less than 8 psi (55 kPa) per ASTM D 1621, and maximum water absorption by volume of 0.6 percent per ASTM C 272.
- I. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, 1/2 inch (13 mm) thick.
- J. Protection Course: Molded-polystyrene board insulation, ASTM C 578, Type I, 0.90-lb/cu. ft. (15-kg/cu. m) minimum density, 1-inch (25-mm) minimum thickness.

2.4 INSULATION DRAINAGE PANELS

- A. Unfaced Wall-Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VI, 40-psi (276-kPa) minimum compressive strength; unfaced; fabricated with shiplap or channel edges and with one side having grooved drainage channels.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include:
 - a. DiversiFoam Products; CertiFoam 40 Drainage Board.
 - b. Dow Chemical Company (The); Styrofoam Perimate.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
- F. Bridge and cover expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.
 - 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
 - b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).
- D. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.
- E. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- F. Seal edges of sheet-waterproofing terminations with mastic.
- G. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.
- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.
- I. Immediately install protection course with butted joints over waterproofing membrane.

3.4 INSULATION DRAINAGE-PANEL INSTALLATION

- A. Install insulation drainage panels over waterproofed surfaces; cut and fit to within 3/4 inch (19 mm) of projections and penetrations.

- B. Ensure that drainage channels are aligned and free of obstructions.
- C. On vertical surfaces, set insulation drainage panels in adhesive or tape applied according to manufacturer's written instructions.
- D. On horizontal surfaces, loosely lay insulation drainage panels according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.5 FIELD QUALITY CONTROL

- A. Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish daily reports to Architect.
- B. Prepare test and inspection reports.

3.6 PROTECTION, REPAIR, AND CLEANING

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

END OF SECTION 071326

SECTION 072100 - THERMAL INSULATION – For Sound Batt Insulation in Interior Walls

1PART - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fiberglass Batt Insulation.
- B. Related Sections include the following:
 - 1. NONE

1.3 DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 PERFORMANCE REQUIREMENTS

- A. Plenum Rating: Provide glass-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 (13-m/s) 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.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.
- D. Research/Evaluation Reports: For foam-plastic insulation.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related 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. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

2PART - PRODUCTS

2.1 MANUFACTURERS

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

2.2 GLASS-FIBER BLANKET INSULATION

- A. Available Manufacturers:
1. CertainTeed Corporation.
 2. Guardian Fiberglass, Inc.
 3. Johns Manville.
 4. Knauf Fiber Glass.
 5. Owens Corning.
- B. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (blankets with membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on 1 face.
- C. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated: Provide an average of R-38 insulation within the attic space.
1. 3-1/2 inches (89 mm) thick with a thermal resistance of 13 deg F x h x sq. ft./Btu at 75 deg F (2.3 K x sq. m/W at 24 deg C).
 2. 3-5/8 inches (92 mm) thick with a thermal resistance of 13 deg F x h x sq. ft./Btu at 75 deg F (1.9 K x sq. m/W at 24 deg C).
 3. 5-1/2 inches (140 mm) thick with a thermal resistance of 19 deg F x h x sq. ft./Btu at 75 deg F (3.3 K x sq. m/W at 24 deg C).
 4. 6-1/2 inches (165 mm) thick with a thermal resistance of 21 deg F x h x sq. ft./Btu at 75 deg F (3.7 K x sq. m/W at 24 deg C).
 5. 9-1/2 inches (241 mm) thick with a thermal resistance of 30 deg F x h x sq. ft./Btu at 75 deg F (5.2 K x sq. m/W at 24 deg C).

2.3 AUXILIARY INSULATING MATERIALS

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.4 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
1. Available Products:
 - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
 - b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
 - c. Gemco; Spindle Type.
 2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.
- B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
1. Available Products:
 - a. AGM Industries, Inc.; RC150.
 - b. AGM Industries, Inc.; SC150.
 - c. Gemco; Dome-Cap.
 - d. Gemco; R-150.
 - e. Gemco; S-150.
- C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
1. Products:
 - a. AGM Industries, Inc.; TACTOO Adhesive.
 - b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
 - c. Gemco; Tuff Bond Hanger Adhesive.

3PART - 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.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 INSTALLATION, GENERAL

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

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- 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. Set vapor-retarder-faced units with vapor retarder to warm-in-winter 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.
- C. Install mineral-fiber insulation 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 cavity, provide lengths that will produce a snug fit between ends.
 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures.
 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically with spindle type fasteners and support faced blankets by taping flanges of insulation to flanges of metal studs.
- D. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

3.5 PROTECTION

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

END OF SECTION 072100

SECTION 072119 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Closed-cell spray polyurethane foam.
- B. Related Requirements:
 - 1. Section 072100 "Thermal Insulation" for foam-plastic board insulation.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.5 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

- A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 2.0 lb/cu ft (32kg/cu m) and minimum aged R-value at 1-inch (25.4-mm) thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F (43 K x sq. m/W at 24 deg C).

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

1. BASF Corporation; Certain Teed Corporation; Dow Chemical Company
2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25.
 - b. Smoke-Developed Index: 450 or less.
3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - a. Provide a 4" average thickness (R=25) of foam.

2.2 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
- B. 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.

3.2 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Framed Construction: Install into cavities formed by framing members to achieve an average thickness of 4 inches.
- E. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.3 PROTECTION

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

END OF SECTION 072119

SECTION 072413 - POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. EIFS-clad barrier-wall assemblies that are field applied over substrate.

1.3 DEFINITIONS

- A. Definitions in ASTM E2110 apply to Work of this Section.
- B. EIFS: Exterior insulation and finish system(s).
- C. IBC: International Building Code.
- D. Polymer-Based Exterior Insulation and Finish System: Class PB EIFS, as defined in ASTM E2568.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each EIFS component, trim, and accessory.
- B. Samples: For each exposed product and for each color and texture specified, 8 inches (200 mm) square in size.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Manufacturer Certificates: Signed by EIFS manufacturer, certifying the following:
 - 1. EIFS substrate is acceptable to EIFS manufacturer.

2. Accessory products installed with EIFS, including joint sealants, flashing, water-resistant barriers, trim, whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.

C. Field quality-control reports.

D. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is certified in writing by system supplier.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

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

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

1. Stack insulation board flat and off the ground.
2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be

applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1. Proceed with installation of adhesives or coatings only when ambient temperatures have remained, or are forecast to remain, above 40 deg F (4.4 deg C) for a minimum of 24 hours before, during, and after application. Do not apply EIFS adhesives or coatings during rainfall.

1.11 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Bond integrity, puncture and weathertightness.
 - b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.
2. Warranty coverage includes the following EIFS components:
 - a. EIFS finish, including base coats, finish coats, and reinforcing mesh.
 - b. Insulation installed as part of EIFS, including buildouts.
 - c. Insulation adhesive.
 - d. EIFS accessories, including trim components and flashing.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: "Outsulation HDC1" - Dryvit
- B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as tested and compatible with EIFS components.

2.2 PERFORMANCE REQUIREMENTS

- A. EIFS Performance: Comply with ASTM E2568 and with the following:
 1. Weathertightness: Resistant to water penetration from exterior.
 2. Structural Performance of Assembly and Components:
 - a. Wind Loads: Uniform pressure as indicated on Drawings.
 3. Impact Performance: ASTM E2568, High impact resistance.

4. Abrasion Resistance of Finish Coat: Sample consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-) thick gypsum board; cured for a minimum of 28 days and shows no cracking, checking, or loss of film integrity after exposure to 528 quarts (500 L) of sand when tested according to ASTM D968, Method A.
5. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch (50.8-by-50.8-mm) clean glass substrate; cured for 28 days and shows no growth when tested according to ASTM D3273 and evaluated according to ASTM D3274.

2.3 EIFS MATERIALS

- A. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.
- B. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate and complying with one of the following:
 1. Factory-mixed noncementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.
- C. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation: Comply with ASTM E2430/E2430M, unless otherwise noted, and the following:
 1. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, according to ASTM E84.
 2. Dimensions: Provide insulation boards of not more than 24 by 48 inches (610 by 1219 mm), with thickness indicated on Drawings.
 3. Foam Buildouts: Provide with profiles and dimensions indicated on Drawings.
- D. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multi-end strands with retained mesh tensile strength of not less than 120 lbf/in. (21 dN/cm) according to ASTM E2098/E2098M and the following:
 1. Reinforcing Mesh for EIFS, General: Not less than weight required to comply with impact-performance level specified in "Performance Requirements" Article.
 2. Strip-Reinforcing Mesh: As recommended by EIFS manufacturer.
 3. Detail-Reinforcing Mesh: As recommended by EIFS manufacturer.
 4. Corner-Reinforcing Mesh: As recommended by EIFS manufacturer.
- E. Base Coat: EIFS manufacturer's standard mixture complying with one of the following:
 1. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.

- F. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
- G. Finish Coat: EIFS elastomeric coating complying with the following:
 - 1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, and fillers used with stone particles for embedding in finish coat to produce an applied-aggregate finish.
 - a. Basis of Design: "Limestone", Dryvit.
 - 2. Colors: As selected by Architect from manufacturer's full range.
 - 3. Textures: As selected by Architect from manufacturer's full range.
- H. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.
- I. Water: Potable.
- J. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D1784 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. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation, with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
 - 3. Expansion Joint: Closed-cell polyethylene backer rod and elastomeric sealant, 3/4-inch (19-mm) minimum.

2.4 MIXING

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

- B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Begin coating application only after surfaces are dry.
 - 2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

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

3.3 EIFS INSTALLATION, GENERAL

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

3.4 SUBSTRATE PROTECTION APPLICATION

- A. Flexible-Membrane Flashing: Apply and lap to shed water; seal at openings, penetrations, and terminations. Prime substrates with flashing primer if required and install flashing.

3.5 TRIM INSTALLATION

- A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints and elsewhere as indicated. Coordinate with installation of insulation.
 - 1. Drip Screed/Track: Use at bottom edges of EIFS unless otherwise indicated.
 - 2. Expansion Joint: Use where indicated on Drawings.
 - 3. Casing Bead: Use at other locations.

3.6 INSULATION INSTALLATION

- A. Board Insulation: Adhesively attach insulation to substrate in compliance with ASTM C1397 and the following:
 - 1. Sheathing: Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of sheathing with adhesive once insulation is adhered to substrate. Apply adhesive to a thickness of not less than 1/4 inch (6.4 mm) for factory

mixed and not less than 3/8 inch (10 mm) for field mixed, measured from surface of insulation before placement.

2. Press and slide insulation into place. Apply pressure over entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
3. Allow adhered insulation to remain undisturbed for not less than 24 hours, before beginning rasping and sanding insulation or before applying base coat and reinforcing mesh.
4. Apply insulation over dry substrates in courses, with long edges of boards oriented horizontally.
5. Begin first course of insulation from a level base line and work upward.
6. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
7. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints, so no piece of insulation is less than 12 inches (300 mm) wide or 6 inches (150 mm) high. Offset joints not less than 6 inches (150 mm) from corners of window and door openings and not less than 4 inches (100 mm) from aesthetic reveals.
 - a. Adhesive Attachment: Offset joints of insulation not less than 6 inches (150 mm) from horizontal and 4 inches (100 mm) from vertical joints in sheathing.
8. Interlock ends at internal and external corners.
9. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch (1.6 mm) occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
10. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
11. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch (0.8 mm) 1/16 inch (1.6 mm) from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch (1.6 mm). Prevent airborne dispersal and immediately collect insulation raspings or sandings.
12. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch (19 mm).
13. Interrupt insulation for expansion joints where indicated.
14. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
15. Before installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches (64 mm) over front and back face unless otherwise indicated on Drawings.

16. Treat exposed edges of insulation as follows:
 - a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
 - b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
 - c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
 17. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS lamina.
- B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:
1. At expansion joints in substrates behind EIFS.
 2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
 3. Where wall height or building shape changes.
 4. Where EIFS manufacturer requires joints in long continuous elevations.
 5. Where panels abut one another.

3.7 BASE-COAT APPLICATION

- A. Base Coat: Apply full coverage to exposed insulation with not less than 1/16-inch (1.6-mm) dry-coat thickness.
- B. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C1397. Do not lap reinforcing mesh within 8 inches (200 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.
- C. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C1397 in same manner as first application. Do not apply until first base coat has cured.
- D. Additional Reinforcing Mesh: Apply strip-reinforcing mesh around openings, extending 4 inches (100 mm) beyond perimeter. Apply additional 9-by-12-inch (230-by-300-mm) strip-reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- (200-mm-) wide, strip-reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches (100 mm) on each side of corners.
1. At aesthetic reveals, apply strip-reinforcing mesh not less than 8 inches (200 mm) wide.
 2. Embed strip-reinforcing mesh in base coat before applying first layer of reinforcing mesh.

3.8 FINISH-COAT APPLICATION

- A. Primer: Apply over dry base coat.
- B. Finish Coat: Apply full-thickness coverage over dry primed base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
 - 1. Embed aggregate in finish coat to produce a uniform applied-aggregate finish of color and texture matching approved sample.
- C. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

3.9 CLEANING AND PROTECTION

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

END OF SECTION 072413

SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Building paper.
 - 2. Building wrap.
 - 3. Flexible flashing.
 - 4. Drainage material.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.
- B. Shop Drawings: Show details of building **wrap** at terminations, openings, and penetrations. Show details of flexible flashing applications.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

- A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
 - 1. Water-Vapor Permeance: Not less than **75 perms** per ASTM E 96/E 96M, Desiccant Method (Procedure A).
 - 2. Air Permeance: Not more than **0.004 cfm/sq. ft.** when tested according to ASTM E 2178.
 - 3. Allowable UV Exposure Time: Not less than three months.
 - 4. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 FLEXIBLE FLASHING

- A. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than **0.025 inch**
 - 1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.
- B. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.
- C. Nails and Staples: Product recommended in writing by flexible flashing manufacturer and complying with ASTM F 1667.

2.3 DRAINAGE MATERIAL

- A. Drainage Material: Product shall maintain a continuous open space between water-resistive barrier and exterior cladding to create a drainage plane and shall be used under **siding**
 - 1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with water-resistive barrier as follows:
 - 1. Cut back barrier **1/2 inch** on each side of the break in supporting members at expansion- or control-joint locations.
 - 2. Apply barrier to cover vertical flashing with a minimum **4-inch** overlap unless otherwise indicated.
- C. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.
 - 1. Seal seams, edges, fasteners, and penetrations with tape.
 - 2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
 - 1. Prime substrates as recommended by flashing manufacturer.
 - 2. Lap seams and junctures with other materials at least **4 inches** except that at flashing flanges of other construction, laps need not exceed flange width.
 - 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 - 4. Lap water-resistive barrier over flashing at heads of openings.
 - 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.3 DRAINAGE MATERIAL INSTALLATION

- A. Install drainage material over building wrap and flashing to comply with manufacturer's written instructions.

END OF SECTION

SECTION 072600 – VAPOR RETARDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Polyethylene vapor retarders.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 POLYETHYLENE VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D4397, 10-mil- (0.25-mm-) thick sheet, with maximum permeance rating of 0.1 perm (5.7 ng/Pa x s x sq. m).
 - 1. Subject to compliance with requirements, available products that may be incorporated into the work, include, but are not limited to the following:
 - a. Viper CS; ISI Building Products, East Peoria, Illinois.

2.2 ACCESSORIES

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS IN CRAWL SPACES

- A. Install vapor retarders over prepared grade. Lap joints a minimum of 12 inches (305 mm) and seal with manufacturer's recommended tape. Install second layer over pathways to equipment.
- B. Extend vapor retarder over footings and seal to foundation wall or grade beam with manufacturer's recommended tape.
 - 1. Extend vapor retarder vertically minimum 16 inches (406 mm) above top of footing and exterior walls.
- C. Seal around penetrations such as utilities and columns in order to create a monolithic, airtight membrane at grade surface, perimeter, and all vertical penetrations.

3.3 PROTECTION

- A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 072600

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes fluid-applied, vapor-permeable membrane air barriers.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 2. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by the Installer, who work on Project.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

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

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 - 1. Build integrated mockups of exterior wall assembly 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Coordinate construction of mockups to permit inspection by Owner's testing agency of air barrier before external insulation and cladding are installed.
 - b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
 - c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
- B. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and complying with VOC content limits of authorities having jurisdiction.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. when tested according to ASTM E 283, ASTM E 783 or ASTM E 2357.

2.3 VAPOR-PERMEABLE MEMBRANE AIR-BARRIER

- A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Elastomeric, modified bituminous or synthetic polymer membrane.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Elastomeric, Modified Bituminous Membrane:

- 1) Henry Company; Air-Bloc 07.
- 2) Hohmann & Barnard, Inc.; Tetroflash Liquid VP.
- 3) Meadows, W. R., Inc.; Air-Shield LMP.
- 4) Tremco Incorporated, an RPM company; ExoAir 220R.

b. Synthetic Polymer Membrane:

- 1) Carlisle Coatings & Waterproofing Inc.; Barritech VP.
- 2) Grace, W. R., & Co. - Conn.; Perm-A-Barrier VP.
- 3) Henry Company; Air-Bloc 31 or Air-Bloc 33.
- 4) Rubber Polymer Corporation, Inc.; Rub-R-Wall Airtight VP.
- 5) Tremco Incorporated, an RPM company; ExoAir 230.

2. Physical and Performance Properties:

- a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
- b. Vapor Permeance: Minimum 10 perms (580 ng/Pa x s x sq. m); ASTM E 96/E 96M.

- c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.

2.4 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.
- B. Primer: Liquid solvent-borne primer recommended for substrate by air-barrier material manufacturer.
- C. Counterflashing Strip: Modified bituminous, 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil- thick, cross-laminated polyethylene film with release liner backing.
- D. Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.
- E. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- F. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- G. Sprayed Polyurethane Foam Sealant: One- or two-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 E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- H. Modified Bituminous Transition Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.
- I. Adhesive-Coated Transition Strip: Vapor-permeable, 17-mil-thick, self-adhering strip consisting of an adhesive coating over a permeable laminate with a permeance value of 37 perms.
- J. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.

3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. 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.
- G. 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 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
 1. 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.
- B. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 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.

3.4 TRANSITION STRIP INSTALLATION

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

- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. 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.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- E. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply adhesive-coated transition strip 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.
 - 1. Adhesive-Coated Transition Strip: Roll firmly to enhance adhesion.
- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- I. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, counterflashing strip.
- J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.5 FLUID AIR-BARRIER MEMBRANE INSTALLATION

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

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

3.6 FIELD QUALITY CONTROL

- A. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Continuous structural support of air-barrier system has been provided.
 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 4. Site conditions for application temperature and dryness of substrates have been maintained.
 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 6. Surfaces have been primed, if applicable.
 7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 8. Termination mastic has been applied on cut edges.
 9. Strips and transition strips have been firmly adhered to substrate.
 10. Compatible materials have been used.
 11. Transitions at changes in direction and structural support at gaps have been provided.
 12. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 13. All penetrations have been sealed.
- B. Air barriers will be considered defective if they do not pass tests and inspections.
 1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 2. Remove and replace deficient air-barrier components for retesting as specified above.

- C. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.7 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
 - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 07 27 26

SECTION 07411.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes standing-seam metal roof panels.
- B. Related Sections:
 - 1. Section 072100 "Thermal Insulation" for insulation under roof panels, with exposed aluminium metal finish.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of 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 purlins and rafters 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 each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Engage a qualified professional engineer, as defined by Section 014000 "Quality Requirements," to prepare Shop Drawings. The professional engineer shall be registered in Florida and shall sign, seal and date any documents for which he or she is responsible.
 - 2. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 3. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Samples for Initial Selection: For each type of metal panel.
 - 1. Include similar Samples of trim and accessories.

1.5 INFORMATIONAL SUBMITTALS

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

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build 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 12 feet (3.5 m) 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 Aluminium metal 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: Twenty years from date of Substantial Completion.
- B. Special Weathertightness Warranty: Manufacturer's no dollar limit 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 PERFORMANCE REQUIREMENTS

- A. Energy Performance: Provide roof panels that are listed on the EPA/DOE's ENERGY STAR "Roof Product List" for low and steep-slope roof products.
- B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 1680 or ASTM E 283 at the following test-pressure difference:
1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 and ASTM E 331 at the following test-pressure difference:
1. Test-Pressure Difference: 15 lbf/sq. ft. (718.2 Pa).
- E. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.
- F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
1. Uplift Rating: UL 90.
- G. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
1. Fire/Windstorm Classification: Class 1A- 120.
 2. Hail Resistance: SH.

- H. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 STANDING-SEAM METAL ROOF PANELS

- A. General: 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 E 1514.
- B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges, panel striations, and a flat pan 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 mechanically seaming panels together.
1. Basis-of-Design Product: Subject to Compliance with requirements, provide Berridge Manufacturing Company; Double-Lock Zee-Lock (180 deg Seam) or comparable product by one of the following:
 - a. AEP Span; A BlueScope Steel Company.
 - b. CENTRIA Architectural Systems.
 - c. MBCI; a division of NCI Group, Inc.
 - d. McElroy Metal, Inc.
 - e. Merchant & Evans Inc.
 - f. Peterson Aluminum
 2. Aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ55 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 24 Gauge.
 3. Clips: Continuous Zee Rib to accommodate thermal movement.
 - a. Material: 0.064-inch- (1.63-mm-) nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 4. Joint Type: Double folded.
 5. Panel Coverage: 16 inches (406 mm).
 6. Panel Height: 2.0 inches (51 mm).

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils (0.76 mm) 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 (116 deg C); ASTM D 1970.
 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Mid-States Asphalt Quick Stick HT Pro
 - b. Polyglass Polystick MTS
 - c. Soprema Lastobond Shield HT
 - d. Tamko TW Underlayment or TW Metal & Tile Underlayment

2.4 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal 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.
- C. 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.
- D. 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- (2400-mm-) long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (914 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match roof fascia and rake trim.

- E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- (3-m-) 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.
- F. Roof Curbs: Fabricated from same material as roof panels, 0.048-inch (1.2-mm) nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of 0.060-inch- (1.52-mm-) nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.
 - 1. Insulate roof curb with 1-inch- (25-mm-) thick, rigid insulation.
- G. Panel Fasteners: Self-tapping screws designed to withstand design loads of zinc coated steel.
- H. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Joint Sealant: ASTM C 920; elastomeric or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

2.5 FABRICATION

- A. General: 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. 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.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are 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.

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 primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 - 2. 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 C 754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

- 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, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
 - 1. Apply over the entire roof surface.
- B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.4 METAL PANEL INSTALLATION

- A. General: 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. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 4. Install flashing and trim as metal panel work proceeds.
 - 5. 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.
 - 6. 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. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
- 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 (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) 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 (914 mm) 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 (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.
1. Provide elbows at base of downspouts to direct water away from building.
 2. Connect downspouts to underground drainage system indicated.
- J. Roof Curbs: Install flashing around bases where they meet metal roof panels.
- K. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) 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

SECTION 076200 - SHEET METAL FLASHING AND TRIM

1PART - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Manufactured Products:

- a. Manufactured through-wall flashing and counterflashing.
- b. Manufactured reglets and counterflashing.

2. Formed Products:

- a. Formed low-slope roof sheet metal fabrications.

B. Related Sections:

- 1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.

1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Fabricate and install copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:

- 1. Wind Zone 1: For velocity pressures of 10 to 20 lbf/sq. ft. (0.48 to 0.96 kPa): 40-lbf/sq. ft. (1.92-kPa) perimeter uplift force, 60-lbf/sq. ft. (2.87-kPa) corner uplift force, and 20-lbf/sq. ft. (0.96-kPa) outward force.
- 2. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft. (1.00 to 1.44 kPa): 60-lbf/sq. ft. (2.87-kPa) perimeter uplift force, 90-lbf/sq. ft. (4.31-kPa) corner uplift force, and 30-lbf/sq. ft. (1.44-kPa) outward force.

3. Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft. (1.48 to 2.15 kPa): 90-lbf/sq. ft. (4.31-kPa) perimeter uplift force, 120-lbf/sq. ft. (5.74-kPa) corner uplift force, and 45-lbf/sq. ft. (2.15-kPa) outward force.
 4. Wind Zone 3: For velocity pressures of 46 to 104 lbf/sq. ft. (2.20 to 4.98 kPa): 208-lbf/sq. ft. (9.96-kPa) perimeter uplift force, 312-lbf/sq. ft. (14.94-kPa) corner uplift force, and 104-lbf/sq. ft. (4.98-kPa) outward force.
- C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 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 manufactured product and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
1. Identification of 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 joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 4. Details of termination points and assemblies, including fixed points.
 5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
 6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 7. Details of special conditions.
 8. Details of connections to adjoining work.
 9. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.

2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
3. Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified fabricator.

B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that 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.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof eave, including coping and flashing, approximately 10 feet (3.0 m) long, including supporting construction cleats, seams, 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.

D. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.

3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.9 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows 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.

2PART - PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 1. Exposed Coil-Coated Finishes:
 - a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear

topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: To be selected by Architect from Manufacturer's full range of colors.
3. Concealed Finish: Pretreat with manufacturer's standard dark-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.2 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
 3. Products: Subject to compliance with requirements, provide one of the following :
 - a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Metal-Fab Manufacturing, LLC; MetShield.
 - e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
- B. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kb/sq. m)minimum, rosin sized.

2.3 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 and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
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.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cheney Flashing Company.
 - b. Fry Reglet Corporation.
 - c. Heckmann Building Products Inc.
 - d. Hickman, W. P. Company.
 - e. Hohmann & Barnard, Inc.; STF Sawtooth Flashing.
 - f. Keystone Flashing Company, Inc.
 - g. National Sheet Metal Systems, Inc.
 - h. Sandell Manufacturing Company, Inc.
2. Material: Aluminum, 0.024 inch (0.61 mm) thick for replacement of existing reglets.
3. Accessories:
 - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard

metal counterflashing or where Drawings show reglet without metal counterflashing.

- b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
- 4. Finish: manufacturer's standard color coating.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
 - 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. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form 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.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
- F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- G. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
- H. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

- I. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- J. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- K. Do not use graphite pencils to mark metal surfaces.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, seal, and solder or weld watertight.

- 1. Coping Profile: SMACNA figure designation 3-4A.
- 2. Joint Style: Butt, with 12-inch- (300-mm-) wide, concealed backup plate.
- 3. Fabricate from the following materials:
 - a. Aluminum: 0.050 inch (1.27 mm) thick.
 - b. Color: Match existing at building.

B. Base Flashing: Fabricate from the following materials:

- 1. Aluminum: 0.040 inch (1.02 mm) thick.

C. Counterflashing: Fabricate from the following materials:

- 1. Aluminum: 0.032 inch (0.81 mm) thick.

D. Flashing Receivers: Fabricate from the following materials:

- 1. Aluminum: 0.032 inch (0.81 mm) thick.

2.7 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings. Form with 2-inch- (50-mm-) high, end dams where flashing is discontinuous. Fabricate from the following materials:

- 1. Copper: 16 oz./sq. ft. (0.55 mm thick).

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

3PART - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Install underlayment as indicated on Drawings.
- B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

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, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. 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.
 - 3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

5. Install sealant tape where indicated.
 6. Torch cutting of sheet metal flashing and trim is not permitted.
 7. Do not use graphite 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 SMACNA.
1. Coat back 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.
 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
- E. Seal joints as shown and as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal 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 and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch (75-mm) centers.

- C. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at 24-inch (600-mm) centers.
- D. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.
1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch (600-mm) centers.
- E. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch (600-mm) centers.
- G. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.
- H. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 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.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 042000 "Unit Masonry."
- C. Reglets: Installation of reglets per manufacture instructions.
- D. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.7 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.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- E. 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 076200

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Roof-edge drainage systems.

- B. Related Requirements:

- 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

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

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

1.3 ACTION SUBMITTALS

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

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

- B. Shop Drawings: For roof specialties.

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

4. Detail termination points and assemblies, including fixed points.
 5. Include details of special conditions.
- C. Samples: For each type of roof specialty and for each color and texture specified.
- D. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.
- E. Samples for Verification:
1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
 2. Include roof-edge drainage systems made from 12-inch (300-mm) lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of roof specialty.
- C. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements for 130 mph wind speed.
- B. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section Insert Section number and title.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.
1. Build mockup of typical roof drainage system, including fascia, gutter and downspout, approximately 10 feet (3.0 m) long, including supporting construction, seams, attachments, and accessories.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

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. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.8 FIELD CONDITIONS

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

1.9 WARRANTY

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 073113.
- B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 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: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

- B. FM Approvals' Listing: Manufacture and install roof-edge drainage specialties that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-120. Identify materials with FM Approvals' markings.
- C. SPRI Wind Design Standard: Manufacture and install copings roof-edge drainage specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:
 - 1. Design Wind Speed: 130 mph .
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 ROOF-EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Architectural Products Company.
 - 2. ATAS International, Inc.
 - 3. Berger Building Products, Inc.
 - 4. Castle Metal Products.
 - 5. Cheney Flashing Company.
 - 6. Exceptional Metals.
 - 7. Perimeter Systems; a division of SAF.
 - 8. SAF (Southern Aluminum Finishing Company, Inc.).
- B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet (3.6 m), with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - 1. Aluminum Sheet: 0.063 inch (1.60 mm) thick.
 - 2. Gutter Profile: Style A according to SMACNA's "Architectural Sheet Metal Manual."
 - 3. Corners: Factory mitered and mechanically clinched and sealed watertight.
 - 4. Gutter Supports: Gutter brackets or Straps with finish matching the gutters.
 - 5. Gutter Accessories: Continuous screened leaf guard with sheet metal frame.

- C. Downspouts: Plain rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Extruded Aluminum: 0.125 inch (3.18 mm) thick.
- D. Aluminum Finish: Two-coat fluoropolymer.
 - 1. Color: White
- E. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
- F. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

2.3 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
- B. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- C. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- F. Pre-cast Concrete Splash Blocks: 12" x 24" x 3" Precast concrete splash blocks.

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 and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Coil-Coated Aluminum Sheet Finishes:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 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.
- E. Aluminum Extrusion Finishes:
1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2604. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 1. Install roof specialties with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 2. Provide uniform, neat seams with minimum exposure of sealant.
 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 4. Torch cutting of roof specialties is not permitted.
 5. Do not use graphite pencils to mark metal surfaces.

- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
- C. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- D. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- E. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.3 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches (610 mm) apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
 - 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.2 m) apart. Install expansion-joint caps.
 - 2. Install continuous leaf guards on gutters with noncorrosive fasteners, removable for cleaning gutters.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c.
 - 1. Provide elbows at base of downspouts at grade to direct water away from building.
 - 2. Connect downspouts to underground drainage system indicated.
- D. Precast Concrete Splash Blocks: Install where downspouts discharge on Grade.

3.4 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Nonstaining silicone joint sealants.
 - 3. Mildew-resistant joint sealants.
 - 4. Latex joint sealants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

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

1.6 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Twenty years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

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

2.2 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following :
 - a. Dow Corning Corporation; 795.
 - b. Pecora Corporation; 895NST.
 - c. Tremco Incorporated; Spectrem 2.

2.3 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following :
 - a. Dow Corning Corporation; 786-M White.
 - b. GE Construction Sealants; SCS1700 Sanitary.
 - c. Tremco Incorporated; Tremsil 200.

2.4 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Construction Chemicals, LLC, Building Systems; Sonolac.
 - b. Pecora Corporation; AC-20.
 - c. Sherwin-Williams Company (The); 850A.
 - d. Tremco Incorporated; Tremflex 834.

2.5 JOINT-SEALANT BACKING

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

2.6 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 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, 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.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 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.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 4. Provide recessed joint configuration of recess depth and at veneer stone applications according to Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 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.

3.5 PROTECTION

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

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces (JS-1).

1. Joint Locations:

- a. Construction joints in cast-in-place concrete.
- b. Joints between plant-precast architectural concrete units.
- c. Control and expansion joints in unit masonry.
- d. Joints in dimension stone cladding.
- e. Perimeter joints between materials listed above and frames of doors windows and louvers.
- f. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement (JS-2).

1. Joint Locations:

- a. Control joints on exposed interior surfaces of exterior walls.
- b. Perimeter joints between interior wall surfaces and frames of interior doors windows and fiber cement siding.
- c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces (JS-3).

1. Joint Locations:

- a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
- b. Tile control and expansion joints where indicated.
- c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors .

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Interior standard steel frames.
 - 2. Exterior standard steel doors and frames.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware for door hardware for hollow-metal doors.

1.3 DEFINITIONS

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

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.

6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

- C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer's: Subject to compliance with requirements, provide products by one of the following:
 1. Amweld Building Products, Inc.
 2. CECO Door Products
 3. Curries Company
 4. Republic Builders Products
 5. Steelcraft

2.2 PERFORMANCE REQUIREMENTS

- A. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.262 deg Btu/F x h x sq. ft. (2.84 W/K x sq. m) when tested according to ASTM C 518.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3; SDI A250.4, Level A.

1. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
- b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
- c. Construction: Full profile welded.

2. Exposed Finish: Prime.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3; SDI A250.4, Level A. At locations indicated in the Door and Frame Schedule.

1. Doors:

- a. Type: As indicated in the Door and Frame Schedule. (6 Panel)
- b. Thickness: 1-3/4 inches (44.5 mm).
- c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A60 (ZF180) coating.
- d. Edge Construction: Model 2, Seamless.
- e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
- f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
- g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
- h. Core: Polystyrene.

2. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A60 (ZF180) coating.
- b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.5 BORROWED LITES

- A. Fabricate of metallic-coated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
- B. Construction: Full profile welded.
- C. 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 at each joint, fabricated of metal of same or greater thickness as metal as frames.
- D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
 - 3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Material: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

2.7 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- E. Glazing: Comply with requirements in Section 088000 "Glazing."

2.8 FABRICATION

- A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
 - 1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding, or by rigid mechanical anchors.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
- B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.
 - 1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 - 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 - 5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.9 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with SDI A250.11.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 - 2. Floor Anchors: Secure with postinstalled expansion anchors.
 - 3. Solidly pack mineral-fiber insulation inside frames.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
 - 5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
 - 1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 CLEANING AND TOUCHUP

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

1PART - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors and transom panels with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Sections:

1. Division 06 Section "Interior Finish Carpentry" for wood door frames including fire-rated wood door frames.
2. Division 06 Section "Interior Architectural Woodwork" for requirements for veneers from the same flitches for both flush wood doors and wood paneling.
3. Division 08 Section "Glazing" for glass view panels in flush wood doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

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

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

- C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide

- set of three samples showing typical range of color and grain to be expected in the finished work.
- 2. Plastic laminate, 6 inches (150 mm) square, for each color, texture, and pattern selected.
- 3. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
 - a. Provide samples for each species of veneer and solid lumber required.
 - b. Provide samples for each color, texture, and pattern of plastic laminate required.
 - c. Finish veneer-faced door samples with same materials proposed for factory-finished doors.
- 4. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.
- 5. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.
- E. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Source Limitations: Obtain flush wood doors and wood paneling from single manufacturer.
- C. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
 - 1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
- D. Forest Certification: Provide doors made with cores and veneers not less than 70 percent of wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- E. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
- F. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.

- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Exterior Doors: Five years from date of Substantial Completion.
 - 4. Warranty Period for Solid-Core Interior Doors: Life of installation.
 - 5. Warranty Period for Hollow-Core Interior Doors: Two year(s) from date of Substantial Completion.

2PART - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Algoma Hardwoods, Inc.
 - 2. Ampco, Inc.
 - 3. Buell Door Company Inc.
 - 4. Chappell Door Co.
 - 5. Eagle Plywood & Door Manufacturing, Inc.

6. Eggers Industries.
7. Graham; an Assa Abloy Group company.
8. Haley Brothers, Inc.
9. Ideal Architectural Doors & Plywood.
10. Ipik Door Company.
11. Lambton Doors.
12. Marlite.
13. Marshfield Door Systems, Inc.
14. Mohawk Flush Doors, Inc.; a Masonite company.
15. Oshkosh Architectural Door Company.
16. Poncraft Door Company.
17. Vancouver Door Company.
18. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

C. 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).

D. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Comply with specified requirements for exposed edges.
3. Pairs: Provide formed-steel edges and astragals.
 - a. Finish steel edges and astragals with baked enamel same color as doors.
 - b. Finish steel edges and astragals to match door hardware (locksets or exit devices).

E. 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 needed to eliminate through-bolting hardware.
 - a. 5-inch (125-mm) top-rail blocking.
 - b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
 - c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.

- d. 5-inch (125-mm) midrail 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:

- 1. Grade: Premium, with Grade AA faces.
- 2. Species: White Birch.
- 3. Cut: Plain sliced (flat sliced).
- 4. Match between Veneer Leaves: Book match.
- 5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
- 6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
- 7. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
- 8. Transom Match: End match.
- 9. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in Division 06 Section "Interior Architectural Woodwork."
- 10. Exposed Vertical and Top Edges: Same species as faces.
- 11. Core: Either glued wood stave or structural composite lumber.
- 12. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
- 13. Construction: Seven plies, either bonded or nonbonded construction.
- 14. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.4 LOUVERS AND LIGHT FRAMES

A. Metal Louvers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Louvers Inc.
 - b. Anemostat; a Mestek company.
 - c. Hiawatha Incorporated.
 - d. L & L Louvers, Inc.
 - e. LL Building Products, Inc.; a division of GAF Materials Corporation.
 - f. Louvers & Dampers, Inc.; a Mestek company.
 - g. McGill Architectural Products.
- 2. Blade Type: Vision-proof, inverted Y.
- 3. Metal and Finish: Extruded aluminum with dark bronze, Class II, color anodic finish, AA-M12C22A32/A34.

B. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Louvers Inc.
 - b. Anemostat; a Mestek company.
 - c. Hiawatha Incorporated.
 - d. L & L Louvers, Inc.
 - e. LL Building Products, Inc.; a division of GAF Materials Corporation.
 - f. Louvers & Dampers, Inc.; a Mestek company.
 - g. McGill Architectural Products.
 2. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, with baked-enamel- or powder-coated finish.
- C. 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.
- D. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
- E. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

1. Fabricate door and transom panels with full-width, solid-lumber meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

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."
3. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory.

C. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.

D. Finish doors at factory where indicated in schedules or on Drawings as factory finished.

E. Transparent Finish:

1. Grade: Premium.
2. Finish: AWI conversion varnish or catalyzed polyurethane system.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
5. Sheen: Satin.

3PART - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

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

3.2 INSTALLATION

FLUSH WOOD DOORS

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels 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 edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.

a. Comply with NFPA 80 for fire-rated doors.

2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.

3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

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 that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Exterior storefront framing.
 - 2. Interior storefront framing for silicone glazing.
 - 3. Exterior manual-swing entrance doors and door-frame units.
 - 4. Interior manual-swing entrance doors and door-frame units.
 - 5. Impact rated with Florida Product Approval

- B. Related Requirements:

- 1. Division 8 Section "Glazing" for glass and glazing in Entrances and Storefronts

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

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

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

- B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

- 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.

- c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
- 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts 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 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. Water penetration through fixed glazing and framing areas.
 - d. Failure of operating components.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: Design Wind Speed is 130 mph, producing a wind pressure of 28psf to be verified by Delegated Design Professional Engineer.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.
3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 11 feet 8-1/4 inches (3.6 m) or 1/175 times span, for spans less than 11 feet 8-1/4 inches (3.6 m).

E. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

2. Entrance Doors:
 - a. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. (2.54 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
 1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
- H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:
 1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
 2. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- I. Energy Performance: Certify and label energy performance according to NFRC as follows:
 1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K) as determined according to NFRC 100.
 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.
- J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
 - b. Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).
 - c. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

2.2 MANUFACTURERS

- A. Basis of Design: Kawneer VG451T Thermal Storefront Framing with Series 350 Medium Stile Swing Entrance Doors with continuous hinges. Omit thermal frames at Interior Storefront and Doors.
- B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Thermally broken.
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: Front.
 - 4. Finish: High-performance organic finish.
 - 5. Fabrication Method: Field-fabricated stick system.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
 - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 - 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 - 1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - 2. Door Design: Medium stile; 3-1/2-inch (88.9-mm) nominal width.
 - 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08711 "Door Hardware."
- B. General: Provide entrance door hardware for each entrance door to comply with requirements in this Section.
 - 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
 - 2. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.
- C. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Continuous Hinges: BHMA A156.26 (All exterior doors).

- E. Pivot Hinges: BHMA A156.4, Grade 1.
 - 1. Offset Pivot Hinges: Provide top, bottom and intermediate offset pivots at each door leaf.
- F. Vertical Rod Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- G. Cylinders: As specified in Section 087111 "Door Hardware."
 - 1. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE".
- H. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- I. Operating Trim: BHMA A156.6.
- J. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
- K. Concealed Overhead Holders: BHMA A156.8, Grade 1.
- L. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
- M. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
- N. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- O. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).

2.6 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: Comply with Section 088000 "Glazing."

2.7 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from exterior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Storefront Framing: Fabricate components for assembly using shear-block system.
- G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At exterior doors, provide compression weather stripping at fixed stops.
- H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- I. 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.
- J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF or FEVE resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: Match Architect's sample As selected by Architect from 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. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

- D. Install components plumb and true in alignment with established lines and grades.

- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

- F. Install glazing as specified in Section 088000 "Glazing."

- G. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

- H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.

2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
 1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
 2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
 - c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
 4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.5 MAINTENANCE SERVICE

- 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.

END OF SECTION 084113

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware for:
 - a. Swinging doors.

1.2 REFERENCES

A. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Key Systems and Nomenclature

B. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

1.3 SUBMITTALS

A. General:

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

B. Action Submittals:

1. Product Data: Product data including manufacturers’ 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. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
 - a. Door Index; include door number, heading number, and Architects hardware set number.
 - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
 - c. Type, style, function, size, and finish of each hardware item.
 - d. Name and manufacturer of each item.
 - e. Fastenings and other pertinent information.
 - f. Location of each hardware set cross-referenced to indications on Drawings.
 - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - h. Mounting locations for hardware.
 - i. Door and frame sizes and materials.
 - j. Name and phone number for local manufacturer's representative for each product.
3. Key Schedule:
 - a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation 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.
 - 1) 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.
4. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. 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. Name, address, and phone number of local representative for each manufacturer.
- d. Parts list for each product.
- e. Final approved hardware schedule, edited to reflect conditions as-installed.
- f. Final keying schedule
- g. Copies of floor plans with keying nomenclature
- h. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.4 QUALITY ASSURANCE

- A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified.
 - 1. Where specific manufacturer's product is named and accompanied by "No Substitute," including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)
 - 2. Where products indicate "acceptable manufacturers", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated.
- B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- E. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.
- F. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbf (22.2 N).
2. Maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches (75 mm) from latch, measured to leading edge of door.

G. Keying Conference: Conduct conference at Project site

1. Attendees: Owner, Contractor, Architect, Installer, and Supplier's Architectural Hardware Consultant.
2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.

H. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
 - a. Attendees: Door hardware supplier, door hardware installer, Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 1. Deliver each article of hardware in manufacturer's original packaging.

C. Project Conditions:

1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

1. Promptly replace products damaged during shipping.
2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

F. Deliver keys to Owner by registered mail or overnight package service.

1.6 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Direct shipments not permitted, unless approved by Contractor.

1.7 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

a. Closers:

- 1) Mechanical: 10 years.

b. Locksets:

- 1) Mechanical: 10 years.

c. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.8 MAINTENANCE

A. Extra Materials:

1. Furnish 100 ea. Schlage Everest D key blanks

B. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and particular project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
- B. 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.
- C. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- 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.

2.2 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.

2.3 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives 5BB series
2. Acceptable Manufacturers and Products: Hager BB series, Stanley FBB Series

B. Requirements:

1. Provide five-knuckle ball bearing hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
3. 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.
4. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Out-Swinging Exterior Doors: Non-removable pins
5. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors.

2.4 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage ND Series
2. Acceptable Manufacturers and Products: Corbin Russwin.

B. Requirements:

1. Provide Schlage ND Series cylindrical locks conforming to the following standards and requirements:
 - a. ANSI/BHMA A156.2 Series 4000, Grade 1.
 - b. UL 10C for 4'-0" x 10'-0" 3-hour fire door.
 - c. Florida Building Code (ASTM E330, E1886, E1996) and Miami Dade (TAS 201, 202, 203) requirements for hurricanes.
2. Cylinders: Refer to "KEYING" article.

3. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
 - a. Abusive Locked Lever Torque Test – minimum 3,100 inch-pounds without gaining access
 - b. Offset lever pull – minimum 1,600 foot pounds without gaining access
 - c. Vertical lever impact – minimum 100 impacts without gaining access
 - d. Cycle life - tested to minimum 16 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers.
4. Provide solid steel anti-rotation through bolts and posts to control excessive rotation of lever.
5. Provide lockset that allows lock function to be changed to over twenty other common functions by swapping easily accessible parts.
6. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw capable of UL listing of 3 hours on a 4' x 10' opening. Provide proper latch throw for UL listing at pairs.
7. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
8. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
9. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
10. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.
 - a. Lever Design: Schlage Rhodes.

2.5 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer: Schlage

B. Requirements:

1. Provide permanent cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article.

2.6 KEYING

- A. Provide cylinders/cores keyed into Owner's existing keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - a. Master Keying system as directed by the Owner.
2. 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.
3. Provide keys with the following features:
 - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
4. 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 cylinders/cores and 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.
 - e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
5. Quantity: Furnish in the following quantities.
 - a. Change (Day) Keys: 3 per cylinder/core.
 - b. Master Keys: 6.

2.7 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer: Telkee
2. Acceptable Manufacturers: HPC, Lund

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.

- a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
- b. Provide hinged-panel type cabinet for wall mounting.

2.8 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4040XP series.
2. Acceptable Manufacturers and Products: Corbin Russwin DC6000 series

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.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 3/4 inch (19 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.9 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Hager, Rockwood

B. Requirements:

1. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
2. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

2.10 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Hager, Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.11 THRESHOLDS, SEALS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International
2. Acceptable Manufacturers: National Guard, Pemko

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:
 - a. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
3. Provide seals and astragals only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.12 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Hager, Rockwood

B. Requirements:

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

2.13 FINISHES

- A. General: Refer to the Hardware Groups.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 2. Custom Steel Doors and Frames: HMMA 831.
 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- I. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- J. Closer/holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- K. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- L. 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.
- M. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

3.3 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant: Engage qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.4 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 six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

- A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.7 DOOR HARDWARE SCHEDULE

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- B. Hardware Sets: - See contract documents.

END OF SECTION

SECTION 088000 ARCHITECTURAL GLASS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. High performance glass of the following types:
 - 1. Insulating glass.
 - 2. Low-e insulating glass.
 - 3. Impact glass.

1.2 RELATED SECTIONS

- A. Section 08400 - Entrances and Storefronts: Exterior Entrances and Storefront.
- B. Section 08500 - Windows: Exterior Windows.

1.3 REFERENCE

- A. ANSI Z97.1 - American National Standard for Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- B. ASCE 7 - "Minimum Design Loads for Buildings and Other Structures".
- C. ASTM International (ASTM):
 - 1. ASTM C 162 - Standard Terminology of Glass and Glass Products.
 - 2. ASTM C 1036 - Standard Specification for Flat Glass.
 - 3. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass -- Kind HS, Kind FT Coated and Uncoated Glass.
 - 4. ASTM C 1172 - Standard Specification for Laminated Architectural Flat Glass.
 - 5. ASTM C 1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
 - 6. ASTM E 2188 - Standard Test Method for Insulating Glass Unit Performance.
 - 7. ASTM E 2189 - Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
 - 8. ASTM E 2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

1.4 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Impact Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or other specified gas.
- D. 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.

1.5 PERFORMANCE REQUIREMENTS

- A. General: Provide glass capable of withstanding thermal movement and wind and impact loads

(where applicable) as specified in paragraph B following.

- B. 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 thicknesses 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) Basic Wind Speed: Per Structural Drawings
 - 2) Importance Factor: Per Structural Drawings
 - 3) Exposure Category: Per Structural Drawings
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from ambient and surface temperatures changes acting on glass framing members and glazing components.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites 1/4 inch (6.0 mm) thick.
 - 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 3. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
 - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. per h per degree F.
 - b. Solar Heat Gain Coefficient: NFRC 200.
 - c. Solar Optical Properties: NFRC 300.

1.6 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: For each glass product and glazing material indicated.
- C. Verification Samples: For the following products, in the form of 12 inch (305 mm) square samples for insulating glass units.
- D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
 - 1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.
- F. Qualification Data: For installers.
- G. Product Test Reports: For each of the following types of glazing products.
 - 1. Tinted float glass.
 - 2. Coated float glass.
 - 3. Insulating glass.
 - 4. Impact glass.
 - 5. Florida Product Approval.
- H. Warranties: Special warranties specified in this Section.

1.7 QUALITY ASSURANCE

- A. Sustainable Design Certification: Glass shall be Cradle to Cradle Certified, minimum Level, Cradle to Cradle Innovation Institute.
- B. Fabricator Qualifications: Vitro Certified Fabricator Network, as acceptable to the manufacturer.
- C. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level-2 (Senior Glaziers) or Level-3 (Master Glaziers).
- D. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: Clear float glass, coated float glass and insulating glass.
- E. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified independent testing agency accredited according to the NFRC CAP1 Certification Agency Program.
- F. Glazing Publications: Comply with published recommendations of glass product manufacturers and industry organizations, including but not limited to those 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. FGIA Publication for Insulating Glass: SFGIA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
 - 2. NGA Publications: "Laminated Glazing Reference Manual"; "Glazing Manual."
 - 3. AAMA: "Sloped Glazing Guidelines."
 - 4. FGIA: "Guidelines for Sloped Glazing."
- G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
 - 1. Insulating Glass Certification Council.
 - 2. Associated Laboratories, Inc.
 - 3. Fenestration and Glazing Industry Alliance.
- H. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, Fenestration and Glazing Industry Alliance ANSI Z97.1.
 - 1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
 - 2. Lites more than 9 sq ft (0.84 sq m) in area are required to be Category II materials.
 - 3. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sf (0.84 sq m) in area, provide glazing products that comply with Category II materials, and for lites 9 sf (0.84 sq m) or less in area, provide glazing products that comply with Category I or II materials.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.9 WARRANTY

- A. Manufacturer's Warranty for Coated-Glass Products: Manufacturer's standard form, made out to the glass fabricator in which the coated glass manufacturer agrees to replace coated glass units that deteriorates during normal use within the specified warranty period. Deterioration of the coated glass is defined as peeling and/or cracking, or discoloration that is not attributed to glass breakage, seal failure, improper installation, or cleaning and maintenance that is contrary to the manufacturer's written instructions.
 - 1. Warranty Period: 10 years from date of manufacture.
- B. Manufacturer's Warranty on Insulating Glass: Manufacturer's standard form in which the insulating glass unit manufacturer agrees to replace insulating-glass units that deteriorate during normal use within the specified warranty period. Deterioration of insulating glass units is defined as an obstruction of vision by dust, moisture, or a film on the interior surfaces of the glass caused by a failure of the hermetic seal that is not attributed to glass breakage, improper installation, or cleaning and maintenance that is contrary to the manufacturer's written instructions.
 - 1. Warranty Period: 10 years from date of manufacture.
- C. Manufacturer's Warranty on Laminated Glass: Manufacturer's standard form in which the laminated glass manufacturer agrees to replace laminated glass units that deteriorate during normal use within the specified warranty period. Deterioration of laminated glass is defined as defects, such as discoloration, edge separation, or blemishes exceeding those allowed by ASTM C 1172 that are not attributed to glass breakage, improper installation, or cleaning and maintenance that is contrary to the manufacturer's written instructions.
 - 1. Warranty Period: 10 years from date of manufacture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Vitro Architectural Glass; Glass Technology Center, 400 Guys Run Rd., Cheswick, PA 15024. ASD. Toll Free Tel: (855) 887-6457. Fax: (800) 367-2986. Web: <http://www.vitroglazings.com>.
- B. Substitutions: Permitted
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 GLASS PRODUCTS

- A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.
 - B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; 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.
 - 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.
 - 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 or required.
- C. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and complying with other requirements specified.
- D. Tempered Patterned Glass: ASTM C 1048, Kind FT (fully tempered), Type II (patterned flat glass), Class 1 (clear), Form 3 (patterned); and of quality, finish, and pattern specified.

E. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 2188 / E 2189 for and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.

1. Provide Kind HS (heat-strengthened) 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.
2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated or required.
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.
4. Sealing System: Comply with requirements in Section 07920 - Joint Sealants. Dual seal, with primary and secondary sealants of polyisobutylene and silicone.
 - a. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
 - b. Spacer Material: Aluminum with mill or clear anodic finish.
 - c. Desiccant: Molecular sieve or silica gel, or blend of both.
 - d. Corner Construction: Manufacturer's standard corner construction.

2.3 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.

2.4 GLASS SCHEDULE, INSULATING GLASS

- A. Type: Clear Insulating Glass - Clear, low-reflective exterior appearance.
 1. Solarban 60 Solar Control Low_E Glass by Vitro Architectural Glass.
 2. Performance Values: VLT 70 percent; SHGC 0.39; shading coefficient 0.45; exterior reflectance 11 percent; U-value winter 0.29; U-value summer 0.27.
 3. Insulating Glass Unit Construction: 1/4 inch (6 mm) Clear glass + 1/2 inch (13 mm) air space + 1/4 inch (6 mm) Clear glass.

2.5

PART 3 EXECUTION

3.1 INSTALLATION

- A. Refer to Section 08800 - Glazing for installation requirements.

END OF SECTION

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.
- B. Studs and Runners: ASTM C 645.

1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
 - b. Depth: 3-5/8 inches (92 mm).
- C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs. Provide firestop tracks at fire rated partitions.
 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.
 - b. Grace Construction Products; FlameSafe FlowTrak System.
 - c. Metal-Lite, Inc.; The System.
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 1. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
- E. Cold-Rolled Channel Bridging: Steel, 0.053-inch (1.34-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
 1. Depth: 1-1/2 inches (38 mm).
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
 2. Depth: 7/8 inch (22.2 mm).
- G. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
 1. Depth: 3/4 inch (19 mm).
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch (0.8 mm).
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

- H. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-metal thickness of 0.018 inch (0.45 mm), and depth required to fit insulation thickness indicated.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide[**one of**] the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.

- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

1PART - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Tile backing panels.

- B. Related Sections include the following:

1. Division 05 Section "Cold-Formed Metal Framing" for load-bearing steel framing that supports gypsum board.
2. Division 07 Section "Thermal Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
3. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.
4. Division 09 Section "Tiling" for cementitious backer units installed as substrates for ceramic tile.
5. Division 09 painting Sections for primers applied to gypsum board surfaces.

1.3 SUBMITTALS

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

- B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.4 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:

- a. Each level of gypsum board finish indicated for use in exposed locations.
- b. Each texture finish indicated.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.

3. Simulate finished lighting conditions for review of mockups.

4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

2PART - PRODUCTS

2.1 PANELS, GENERAL

A. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 10 percent by weight.

- B. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum Co.
 - b. BPB America Inc.
 - c. G-P Gypsum.
 - d. Lafarge North America Inc.
 - e. National Gypsum Company.
 - f. PABCO Gypsum.
 - g. Temple.
 - h. USG Corporation.

B. Regular Type:

1. Thickness: 5/8 inch (12.7 mm).
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Type X:

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

D. Type C:

1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
2. Long Edges: Tapered.

- E. Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: 1/4 inch (6.4 mm).
2. Long Edges: Tapered.

- F. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 5/8 inch (12.7 mm).
2. Long Edges: Tapered.

- G. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.

1. Core: 5/8 inch (12.7 mm), regular type; 5/8 inch (15.9 mm), Type X.

2. Long Edges: Tapered.

H. High-Impact Type: Manufactured with Type X core, plastic film laminated to back side for greater resistance to through-penetration (impact resistance).

1. Core: 5/8 inch (15.9 mm) thick.
2. Plastic-Film Thickness: 0.030 inch (0.762 mm).

I. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.

2.3 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Exterior Gypsum Soffit Board: ASTM C 931/C 931M or ASTM C 1396/C 1396M, with manufacturer's standard edges.

B. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.

1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum.
2. Core: 5/8 inch (15.9 mm), Type X.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; Wonderboard.
 - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - c. USG Corporation; DUROCK Cement Board.
2. Thickness: 1/2 inch (12.7 mm).

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.

g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
3. Finish: Insert requirements for Class II anodic finishes and factory-painted, baked-enamel finishes.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
3. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 10 percent by weight.

E. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

1. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

G. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

3PART - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

- 1. Regular Type: Vertical surfaces, unless otherwise indicated.
- 2. Type X: Where required for fire-resistance-rated assembly.
- 3. Flexible Type: Apply in double layer at curved assemblies.
- 4. Ceiling Type: Ceiling surfaces.
- 5. Abuse-Resistant Type: As indicated on Drawings.
- 6. Moisture- and Mold-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:

- 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
- 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) , unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
- 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

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 1 framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
- 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
- 3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical

joints offset at least one furring member. Locate edge joints of base layer over furring members.

4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.

1. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

3.5 APPLYING TILE BACKING PANELS

A. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

B. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

C. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

D. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.

E. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by the Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. U-Bead: Use at exposed panel edges.
5. Curved-Edge Cornerbead: Use at curved openings.

D. Exterior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.

E. Aluminum Trim: Install in locations indicated on Drawings.

3.7 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

a. Primer and its application to surfaces are specified in other Division 09 Sections.

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.8 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 - TILING

1 PART - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Ceramic tile.
2. Stone thresholds.
3. Waterproof membrane.
4. Crack isolation membrane.
5. Tile backing panels.
6. Metal edge strips.

B. Related Sections:

1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Division 09 Section "Gypsum Board" for cementitious back units.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

- B. 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.

1.4 SUBMITTALS

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

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

D. 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.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches (300 mm) square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Stone thresholds in 6-inch (150-mm) lengths.
5. Metal edge strips in 6-inch (150-mm) lengths.

E. Qualification Data: For qualified Installer.

F. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

G. Product Certificates: For each type of product, signed by product manufacturer.

H. Material Test Reports: For each tile-setting and -grouting product and special purpose tile.

1.5 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

1. Stone thresholds.
2. Waterproof membrane.
3. Crack isolation membrane.
4. Joint sealants.
5. Cementitious backer units.
6. Metal edge strips.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials 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.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

2 PART - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

E. 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.

2.2 TILE PRODUCTS

A. Tile Type – See Drawings

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Marazzi Tile, Inc.
- b. American Olean; Division of Dal-Tile International Inc.
- c. Crossville, Inc.
- d. Daltile; Division of Dal-Tile International Inc.
- e. Deutsche Steinzeug America, Inc.
- f. Ergon
- g. Florida Tile Industries, Inc.
- h. Florim USA.
- i. Graniti Fiandre; c/o Trans Ceramica, Ltd.
- j. GST
- k. Interceramic.
- l. Laufen.
- m. Lone Star Ceramics Company.
- n. Grupo Porcelanite.
- o. Marca Carona
- p. Portobello America, Inc.
- q. Provenza
- r. Roca Stratos

- s. Seneca Tiles, Inc.
 - t. United States Ceramic Tile Company.
2. Composition: Porcelain.
 3. Face Size: As indicated below and on drawings.
 4. Thickness: 3/8 inch (9.5 mm).
 5. Face: Plain with square or cushion edges.
 6. Finish: Polished, Unpolished and Textured. - See below for type.
 7. Tile Color and Pattern: As selected by Architect from manufacturer's full range.
 8. Grout Color: As selected by Architect from manufacturer's full range.

B. Porcelain Floor tile – See drawings

C. Porcelain Wall tile – See Drawings

- 1.
- D. Wall Tile See drawings.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Marazzi Tile, Inc.
 - b. American Olean; Division of Dal-Tile International Inc.
 - c. Daltile; Division of Dal-Tile International Inc.
 - d. Deutsche Steinzeug America, Inc.
 - e. Florim USA.
 - f. Laufen.
 - g. Grupo Porcelanite.
 - h. Portobello America, Inc.
 - i. Seneca Tiles, Inc.
 - j. United States Ceramic Tile Company.
 - k. Interceramic
2. Module Size: 4" x 4" inches (108 by 108 mm).
3. Thickness: 5/16 inch (8 mm).
4. Face: Plain with modified square edges or cushion edges.
5. Finish: Bright, opaque glaze.
6. Tile Color and Pattern: As selected by Architect from manufacturer's full range .
7. Grout Color: As selected by Architect from manufacturer's full range.
8. Mounting: Factory, back mounted.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base for Portland Cement Mortar Installations: Coved, module size 4-1/4 by 4-1/4 inches (108 by 108 mm).
 - b. Base for Thin-Set Mortar Installations: Straight, module size 4-1/4 by 4-1/4 inches (108 by 108 mm).
 - c. Wainscot Cap for Portland Cement Mortar Installations: Bullnose cap, module size 4-1/4 by 4-1/4 inches (108 by 108 mm).

- d. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 4-1/4 by 4-1/4 inches (108 by 108 mm).
- e. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
- f. External Corners for Portland Cement Mortar Installations: Bullnose shape with radius of at least 3/4 inch (19 mm) unless otherwise indicated.
- g. External Corners for Thin-Set Mortar Installations: Surface bullnose, same size as adjoining flat tile.
- h. Internal Corners: Field-buttet square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.

2.3 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

- 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.

- 1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, in maximum lengths available to minimize end-to-end butt joints.

- 1. Products: Subject to compliance with requirements, provide one of the following :

- a. C-Cure; C-Cure Board 990.
- b. Custom Building Products; Wonderboard.
- c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
- d. USG Corporation; DUROCK Cement Board.

- 2. Thickness: 5/8 inch (15.9 mm) As indicated.

2.5 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. 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 the following :
 - a. Boiardi Products; a QEP company; Elastiment 344 Reinforced Waterproofing and Anti-Fracture/Crack Suppression Membrane.
 - b. Bonsal American; an Oldcastle company; B 6000 Waterproof Membrane with Glass Fabric.
 - c. Bostik, Inc.; Hydroment Blacktop 90210.
 - d. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
 - e. Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane.
 - f. MAPEI Corporation; Mapelastic L (PRP M19).
 - g. Mer-Kote Products, Inc.; Hydro-Guard 2000.
 - h. Summitville Tiles, Inc.; S-9000.

2.6 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
 1. Products: Subject to compliance with requirements, provide one of the following :
 - a. Boiardi Products; a QEP company; Elastiment 344 Reinforced Waterproofing and Anti-Fracture/Crack Suppression Membrane.
 - b. Bonsal American; an Oldcastle company; B 6000 Waterproof Membrane with Glass Fabric.
 - c. Bostik, Inc.; Hydroment Blacktop 90210.
 - d. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
 - e. Laticrete International, Inc.; Laticrete Blue 92 Anti-Fracture Membrane .
 - f. MAPEI Corporation; Mapelastic L (PRP M19).
 - g. Mer-Kote Products, Inc.; Hydro-Guard 2000.
 - h. Summitville Tiles, Inc.; S-9000.
- C. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
 1. Products: Subject to compliance with requirements, provide one of the following :
 - a. C-Cure; UltraCure 971.
 - b. MAPEI Corporation; Mapelastic (PRP 315).
 - c. TEC; a subsidiary of H. B. Fuller Company; Triple Flex Waterproofing, Crack Isolation Membrane & Mortar.
- D. Urethane Crack Isolation Membrane and Tile-Setting Adhesive: One-part, liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.

1. Products: Subject to compliance with requirements, provide one of the following :

a. Bostik, Inc.; Durabond D-200.

2.7 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Boiardi Products; a QEP company.
- b. Bonsal American; an Oldcastle company.
- c. Bostik, Inc.
- d. C-Cure.
- e. Custom Building Products.
- f. Jamo Inc.
- g. Laticrete International, Inc.
- h. MAPEI Corporation.
- i. Mer-Kote Products, Inc.
- j. Southern Grouts & Mortars, Inc.
- k. Summitville Tiles, Inc.
- l. TEC; a subsidiary of H. B. Fuller Company.

- 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
- 3. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
- 4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.8 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

B. Polymer-Modified Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Boiardi Products; a QEP company.
- b. Bonsal American; an Oldcastle company.
- c. Bostik, Inc.
- d. C-Cure.
- e. Custom Building Products.
- f. Jamo Inc.
- g. Laticrete International, Inc.
- h. MAPEI Corporation.

- i. Southern Grouts & Mortars, Inc.
 - j. Summitville Tiles, Inc.
 - k. TEC; a subsidiary of H. B. Fuller Company.
- 2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
 - 3. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.

2.9 ELASTOMERIC SEALANTS

- A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."
 - 1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. 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: Subject to compliance with requirements, provide one of the following:
 - a. DAP Inc.; Titanium Enriched Kitchen and Bath Sealant.
 - b. Dow Corning Corporation; Dow Corning 786.
 - c. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
 - d. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
 - e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
 - f. Tremco Incorporated; Tremsil 600 White.
- 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: Subject to compliance with requirements, provide one of the following provide one of the following:
 - a. Bostik, Inc.; Chem-Calk 550.
 - b. Degussa Building Systems; Sonneborn Sonolastic SL 2.
 - c. Pecora Corporation; Dynatrol II-SG.
 - d. Sika Corporation; Sikaflex-2c SL.
 - e. Tremco Incorporated.; THC-900.

2.10 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. 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; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
- 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, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) 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. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bonsal American; an Oldcastle company; Grout Sealer.
 - b. Bostik, Inc.; CeramaSeal Grout & Tile Sealer.
 - c. C-Cure; Penetrating Sealer 978.
 - d. Custom Building Products; Surfaceguard Sealer.
 - e. Jamo Inc.; Matte Finish Sealer.
 - f. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout.
 - g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
 - h. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
 - i. TEC; a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone Grout Sealer.

2.11 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
- B. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
- C. Verify that concrete substrates for tile floors installed with adhesives bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
- D. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
- E. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
- F. 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.
- G. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: If 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 TILE INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- B. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
 - 1. Exterior tile floors.
 - 2. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
 - 3. Tile floors composed of rib-backed tiles.
- 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.
- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
 - 2. Quarry Tile: 3/8 inch (9.5 mm).
 - 3. Paver Tile: 3/8 inch (9.5 mm).
 - 4. Glazed Wall Tile: 1/16 inch (1.6 mm).
 - 5. Decorative Thin Wall Tile: 1/16 inch (1.6 mm).
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- I. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
 1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
 2. Do not extend cleavage membrane waterproofing or crack isolation membrane under thresholds set in dry-set portland cement or latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane waterproofing or crack isolation membrane with elastomeric sealant.
- J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- K. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKING PANEL INSTALLATION

- A. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.7 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove epoxy and 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 and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

1. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
2. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

1PART - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes acoustical panels and exposed suspension systems for ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.3 DEFINITIONS

- A. AC: Articulation Class.
- B. CAC: Ceiling Attenuation Class.
- C. LR: Light Reflectance coefficient.
- D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Ceiling suspension system members.
 - 2. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 4. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).
- C. Samples for Initial Selection: For components with factory-applied color finishes.

- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.
- E. Qualification Data: For testing agency.
- F. Field quality-control test reports.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.
- H. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor and fastener type.
- I. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- B. Source Limitations:
1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
 2. Suspension System: Obtain each type through one source from a single manufacturer.
- C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - b. Identify materials with appropriate markings of applicable testing and inspecting agency.
 2. 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: 450 or less.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 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.

1.7 PROJECT 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.

1.8 COORDINATION

- 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.

1.9 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. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
 - 2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

3. Hold-Down Clips: Equal to 2.0 percent of quantity installed.

2PART - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 10 percent by weight.

B. 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 reflectances, 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 (400 mm) away from test surface per ASTM E 795.

C. 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 Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

D. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

E. Antimicrobial Fungicide Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING ACT-1

A. Products: Subject to compliance with requirements, provide one of the following: - See the contract documents for the basis of design

1. Armstrong World Industries, Inc.
2. BPB USA.
3. Chicago Metallic Corporation.
4. Ecophon CertainTeed, Inc.
5. Tectum Inc.
6. USG Interiors, Inc.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product or a comparable product by one of the following:

1. See the Contract Documents

C. Color: White.

D. LR: Not less than 0.85.

E. NRC: Not less than 0.75.

F. CAC: Not less than 35.

G. Edge/Joint Detail: Beveled Tegular.

H. Thickness: 3/4 inch (19 mm).

I. Modular Size: 24 by 24 inches (610 by 610 mm).

J. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

2.3 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING ACT-2

A. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.
2. BPB USA.
3. Chicago Metallic Corporation.
4. Ecophon CertainTeed, Inc.
5. Tectum Inc.
6. USG Interiors, Inc.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product or a comparable product by one of the following:

1. USG – See the Contract Documents

C. Color: White.

D. LR: Not less than 0.85.

E. NRC: Not less than 0.75.

F. Edge/Joint Detail: Square Tegular.

G. Thickness: 1 inch (25 mm).

H. Modular Size: 24 by 60 inches (610 by 610 mm).

I. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. 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.

C. 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.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

D. 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: Postinstalled expansion 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.

c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.

d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.

3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.

4. 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- (3.5-mm-) diameter wire.

- F. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- G. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
- H. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- I. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- J. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.
- K. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.
- L. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.5 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. BPB USA.
 - 3. Chicago Metallic Corporation.
 - 4. Ecophon CertainTeed, Inc.
 - 5. USG Interiors, Inc.
- C. Basis-of-Design Product: Subject to compliance with requirements, provide below or a comparable product by one of the following:
 - 1. Armstrong World Industries, Inc.
- D. Narrow-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/A 653M, not less than G30 (Z90) coating designation, with prefinished 9/16-inch- (15-mm-) wide metal caps on flanges.

 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/A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16-inch- (15-mm-) wide metal caps on flanges.
- 1. Structural Classification: Heavy-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 in color as selected from manufacturer's full range.

2.6 METAL EDGE MOLDINGS AND TRIM

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

B. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.
2. BPB USA.
3. Chicago Metallic Corporation.
4. Fry Reglet Corporation.
5. Gordon, Inc.
6. USG Interiors, Inc.

C. Basis-of-Design Product: Subject to compliance with requirements, provide below or a comparable product by one of the following:

1. Armstrong: Match Suspension System at walls and soffits.
2. Armstrong: Facia Molding #7816 at floating ceiling units

2.7 ACOUSTICAL SEALANT

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

B. Products: Subject to compliance with requirements, provide one of the following:

1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.
2. Acoustical Sealant for Concealed Joints:
 - a. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
 - b. Pecora Corporation; BA-98.
 - c. Tremco, Inc.; Tremco Acoustical Sealant.

3PART - 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.

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

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

- 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

- B. Suspend ceiling hangers from building's structural members and as follows:

- 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
- 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
- 3. 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.
- 4. 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.
- 5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
- 6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
- 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, or power-actuated fasteners that extend through forms into concrete.
- 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 (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. 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 (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - b. Install panels with pattern running in one direction parallel to short axis of space.
 - c. Install panels in a basket-weave pattern.
 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
 5. 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.
 6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
 7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.

8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

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. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Vinyl base.
 - 2. Vinyl molding accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches (300 mm) long.
- C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

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 (10 deg C) or more than 90 deg F (32 deg C).

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C)
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL BASE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong World industries, Inc.
 - 2. Burke Mercer Flooring Products
 - 3. Flexco
 - 4. Johnsonite, a Tarkett Company
- B. Product Standard: ASTM F1861, Type TV (vinyl, thermoplastic).
 - 1. Group: II (layered).
 - 2. Style and Location:
 - a. Style B, Cove: Provide in areas with resilient floor coverings.
- C. Minimum Thickness: 0.125 inch (3.2 mm)
- D. Height: 4 inches (152 mm)
- E. Lengths: Coils in manufacturer's standard length
- F. Outside Corners: Preformed
- G. Inside Corners: Job formed or preformed.
- H. Colors and Patterns: See Material Legend as delineated on Sheet ID1.1.

2.2 VINYL MOLDING ACCESSORY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong World industries, Inc.
 - 2. Burke Mercer Flooring Products
 - 3. Flexco
 - 4. Johnsonite, a Tarkett Company
- B. Description: Vinyl 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. Profile and Dimensions: As required.
- D. Locations: Provide vinyl molding accessories as required.
- E. Colors and Patterns: Match adjacent assemblies.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

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. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

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.
- C. Install resilient base in lengths as long as practical 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 12 inches (304 mm) in length.
 - a. Miter or cope corners to minimize open joints.

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 covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal 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 subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

Section Includes:

- 1. Vinyl Composite Tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of products specified.
- B. Samples for Initial Selection: For each type of floor tile indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

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 (10 deg C) or more than 90 deg F (32 deg C). 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 (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following periods:

1. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

2.2 RESILIENT TILE – See the contract documents for the basis of design.

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

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles as Architect shows on plans.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain running in one direction.
- 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 marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation 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 substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

- D. Joint Sealant: Apply sealant to resilient terrazzo floor tile perimeter and around columns, at door frames, and at other joints and penetrations.
- E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes modular, carpet tile.
- B. Related Requirements:
 - 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include installation recommendations for each type of substrate.
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.
 - 4. Type of installation.
 - 5. Pattern of installation.
 - 6. Pattern type, location, and direction.
 - 7. Pile direction.
 - 8. Type, color, and location of insets and borders.

9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 1. Carpet Tile: Full-size Sample.
 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.
- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
- E. Sustainability: Provide the Statement of the Achievement Level the carpet has attained for Bronze, 28 to 36 points, based on specific Sustainable Attribute Performance for all product stages according to ANSI/NSF 140.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

- C. 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 mockups at locations and in sizes shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.10 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. 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 agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE: See Drawings

- A. Color to be selected by Architect from Manufacturers' full range of colors.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Metal Edge/Transition Strips: Extruded 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- 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.
- 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 the following operations immediately after installing carpet tile:
 - 1. Remove yarns that protrude from carpet tile surface.
 - 2. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 096900 - ACCESS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cementitious-core steel panel access flooring.
2. Wood-core steel panel access flooring.
3. Unfilled steel panel access flooring.
4. Aluminum panel access flooring.
5. Access-floor coverings.
6. Accessories.

1.2 DEFINITIONS

- A. ESD: Electrostatic discharge. The transfer of electric charge between bodies at different potentials, from panel surface to raised access-floor substructure.
- B. UFAD: Underfloor air distribution.

1.3 COORDINATION

- A. Coordinate locations, layout, and installation of electrical and mechanical work in underfloor cavity to prevent interference with access flooring.
1. Mark pedestal locations on subfloor to enable mechanical and electrical work to proceed without interfering with access-flooring pedestals installed after mechanical and electrical work.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference via Video Conference.
1. Review connections between access flooring and mechanical and electrical systems.
 2. Review procedures for keeping underfloor space clean.

1.5 ACTION SUBMITTALS

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

- a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- b. Include loading capacities.

B. Shop Drawings:

- 1. Layout of access flooring and relationship to adjoining Work based on field-verified dimensions.
- 2. Details and sections with descriptive notes indicating materials, finishes, fasteners, typical and special edge conditions, accessories, and understructures.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish:

D. Samples for Verification: For the following products:

- 1. Exposed Metal Accessories: Approximately 10 inches (250 mm) in length.
- 2. One full-size floor panel, pedestal, and understructure unit for each type of access flooring required.
- 3. Access-Floor Coverings: Full-size units for each color and texture specified.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of access flooring.
- B. Product Test Reports: For each type of access-flooring panel material[**and floor covering**], for tests performed by a qualified testing agency.
- C. Preconstruction Test Reports: For preconstruction adhesive field test.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in Florida where Project is located and who is experienced in providing engineering services of the type indicated.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install access flooring until spaces are enclosed and the ambient temperature is between **50 and 90 deg F (10 and 32 deg C)**, and relative humidity is not less than 20 and not more than 70 percent.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain products from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design access flooring for seismic performance, including loads imposed on the access flooring by items and equipment installed on the access flooring.
- B. Structural Performance: Provide access flooring capable of complying with the following performance requirements in accordance with testing procedures in CISCA's "Recommended Test Procedures for Access Floors":
- C. Fire Performance:
 1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: **[25] <Insert value>** or less.
 - b. Smoke-Developed Index: **[50] [450] <Insert value>** or less.

2.3 UNFILLED STEEL PANEL ACCESS FLOORING **<Insert drawing designation>**

- A. Provide panels fabricated from cold-rolled steel sheet, with die-cut flat top sheet and die-formed and stiffened bottom pan welded together. Protect metal surfaces against corrosion by manufacturer's standard factory-applied finish.
- B. Configuration: Provide modular panels with nominal size of **24 by 24 inches** interchangeable with other field panels without disturbing adjacent panels or understructure.
- C. Attachment to Understructure: **Bolted**

2.4 ACCESS-FLOOR COVERINGS

- A. Provide factory-applied floor finish fabricated in one piece to cover entire panel face; with **[integral trim]** **[applied perimeter plastic]** edging.
1. Static-Dissipative Vinyl Tile: ASTM F1700, Class I (monolithic vinyl tile), Type A (smooth surface).
 - a. Electrical Resistance: Average no less than 1 megohm and no more than 1000 megohms when installed floor coverings are surface-to-ground tested in accordance with ASTM F150 with 100 V applied voltage.
 - b. Color, Texture, and Pattern: **[As indicated by manufacturer's designations]** **[Match Architect's samples]** **[As selected by Architect from manufacturer's full range]** **<Insert color, texture, and pattern>**.
 2. Carpet Tile: Manufacturer's standard tufted, modular carpet tile product.
 - a. Electrostatic Propensity: Less than 3.5 kV when tested in accordance with AATCC 134.
 - b. Color, Texture, and Pattern: **[As indicated by manufacturer's designations]** **[Match Architect's samples]** **[As selected by Architect from manufacturer's full range]** **<Insert color, texture, and pattern>**.

2.5 FABRICATION

- A. Fabrication Tolerances:
1. Panel Size: Plus or minus **0.020 inch (0.50 mm)** of required size.
 2. Squareness: Plus or minus **0.015 inch (0.38 mm)** between diagonal measurements across top of panel.
 3. Flatness: Plus or minus **0.035 inch (0.89 mm)**, measured on a diagonal on top of panel.
- B. Panel Markings: Clearly and permanently mark floor panels on their underside with panel type and concentrated-load rating.
- C. Bolted Panels: Provide panels with holes drilled in corners to align precisely with threaded holes in pedestal heads and to accept countersunk screws with heads flush with top of panel.
1. Captive Fasteners: Provide fasteners held captive to panels.
- D. Cutouts: Fabricate cutouts in floor panels for cable penetrations and service outlets. Provide reinforcement or additional support, if needed, to make panels with cutouts comply with structural performance requirements.
1. Number, Size, Shape, and Location: As indicated on Drawings.
 2. Grommets: Where indicated, fit cutouts with manufacturer's standard grommets; or, if size of cutouts exceeds maximum grommet size available, trim edge of cutouts with manufacturer's standard plastic molding with tapered top flange. **[Furnish removable covers for grommets.]**
 3. Provide foam-rubber pads for sealing annular space formed in cutouts by cables.

2.6 ACCESSORIES

- A. Pedestal System Understructure: System consisting of base, column with provisions for height adjustment, and head (cap); made of **steel**.
1. Base: Square or circular base with not less than [**16 sq. in. (103 sq. cm)**] of bearing area.
 2. Column: Of height required to bring finished floor to elevations indicated. Weld column to base plate.
 3. Provide vibration-proof leveling mechanism for making and holding fine adjustments in height over a range of not less than [**2 inches (51 mm)**] and for locking at a selected height, so deliberate action is required to change height setting and prevent vibratory displacement.
 4. Head: Designed to support the floor panel indicated.
 - a. Provide sound-deadening pads or gaskets at contact points between heads and panels.
 - b. Bolted Assemblies: Provide head with four holes aligned with holes in floor panels for bolting of panels to pedestals..
- B. Stringer System Understructure: Modular **steel** stringer systems designed to bolt to pedestal heads and form a grid pattern.**Protect steel components with manufacturer's standard galvanized or corrosion-resistant paint finish.**
1. Continuous Gaskets: At contact surfaces between panel and stringers to deaden sound, seal off the underfloor cavity from above, and maintain panel alignment and position.
- C. Adhesives: Manufacturer's standard adhesive for bonding pedestal bases to subfloor.
- D. pedestal bases to subfloor, provide [**two**] [**four**] post-installed **expansion anchors** made from carbon steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5 (5 microns) for Class SC 1 (Mild), with the capability to sustain, without failure, a load equal to [**1.5**] times the loads imposed by pedestal-overturning moment on fasteners, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- E. Service Outlets: Standard UL-listed and -labeled assemblies, for recessed mounting flush with top of floor panels; for power, communication, and signal services; and complying with the following requirements:
1. Structural Performance: Cover capable of supporting a [**300 lbf (1334 N)**] [**800 lbf (3559 N)**] [**1000 lbf (4448 N)**] concentrated load.
 2. Cover and Box Type: [**Hinged polycarbonate cover with opening for passage of cables when cover is closed and including frame and steel box or formed-steel plate for mounting electrical receptacles**] [**Grommet with twist-close cover and including steel junction box for electrical receptacle with provision for telephone connectors and signal cables**] <Insert type>.
 3. Location: In center of panel quadrant unless otherwise indicated.
 4. Receptacles and Wiring:
 - a. Electrical receptacles and wiring for service outlets are specified elsewhere.
 - b. Equip each service outlet with power receptacles to comply with the following requirements:

- 1) Type of Receptacle: Heavy-duty duplex, two-pole, three-wire grounding, 20 A, 125 V, NEMA WD 6, Configuration 5-20R unless otherwise indicated.
- 2) Number of Receptacles for Outlet: [**One**] [**Two**] [**Four**] <Insert number>.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer and manufacturer's authorized representative present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. Verify that substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of conditions and deleterious substances that might interfere with attachment of pedestals.
 2. Verify that concrete floor sealer and finish have been applied and cured.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Lay out floor panel installation to keep the number of cut panels at floor perimeter to a minimum. Avoid using panels cut to less than **6 inches (152 mm)**.
- B. Locate each pedestal, complete any necessary subfloor preparation, and vacuum subfloor to remove dust, dirt, and construction debris before beginning installation.

3.3 INSTALLATION

- A. Install access flooring and accessories under supervision of access-flooring manufacturer's authorized representative to produce a rigid, firm installation that complies with performance requirements and is free of instability, rocking, rattles, and squeaks.
- B. Adhesive Attachment of Pedestals: Set pedestals in adhesive, in accordance with access-flooring manufacturer's written instructions, to provide full bearing of pedestal base on subfloor[; **and as required to meet seismic design requirements**].
- C. Mechanical Attachment of Pedestals: Attach pedestals to subfloor with post-installed mechanical anchors in accordance with access-flooring manufacturer's written instructions[**as required to meet seismic design requirements**].
- D. Adjust pedestals so installed panels are flat, level, and at the proper height.
- E. Stringer Systems: Secure stringers to pedestal heads in accordance with access-flooring manufacturer's written instructions.

- F. Install flooring panels securely in place, leaving them properly seated with panel edges flush. Do not force panels into place.
- G. Scribe perimeter panels to provide a close fit, with adjoining construction having no voids greater than **1/8 inch (3 mm)** where panels abut vertical surfaces.
 - 1. To prevent dusting, seal cut edges of steel-encapsulated, wood-core panels with sealer recommended in writing by access-flooring manufacturer.
- H. Cut and trim access flooring and perform other dirt-or-debris-producing activities at a remote location or as required to prevent contamination of subfloor under installed access flooring.
- I. Grounded Access Flooring: Ground in accordance with access-flooring manufacturer's written instructions and as needed to comply with performance requirements for electrical resistance of floor coverings.
 - 1. Panel-to-Understructure Resistance: Not more than 10 ohms as measured without floor coverings.
- J. Underfloor Dividers: Scribe and install underfloor-cavity dividers to closely fit against subfloor surfaces, and seal with mastic.
- K. Closures: Scribe closures to closely fit against subfloor and adjacent finished-floor surfaces. Set in mastic and seal to maintain plenum effect within underfloor cavity.
- L. Clean dust, dirt, and construction debris caused by floor installation, and vacuum subfloor area as installation of floor panels proceeds.
- M. Install access flooring without change in elevation between adjacent panels and within the following tolerances:
 - 1. Plus or minus [**1/16 inch (1.5 mm)**] in any **10 ft. (3 m)** distance.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect access-flooring components, assemblies, and equipment installations, including connections.
- B. Prepare test and inspection reports.

3.5 PROTECTION

- A. Prohibit traffic on access flooring for 24 hours and removal of floor panels for [72] **<Insert number>** hours after installation, to allow pedestal adhesive to set.
- B. Replace access-flooring panels that are stained, scratched, or otherwise damaged or that do not comply with specified requirements.

3.6 DEMONSTRATION AND TRAINING

- A. **[Engage a factory-authorized service representative to train]** [Train] Owner's maintenance personnel to adjust, operate, and maintain access flooring.
- B. Schedule demonstration and training session within **[60 to 90]** <Inset number> days after date of Substantial Completion.

END OF SECTION 096900

SECTION 099113 - EXTERIOR PAINTING

1 PART - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior substrates.
 - 1. Concrete.
 - 2. Clay masonry.
 - 3. Concrete masonry units (CMU).
 - 4. Steel.
 - 5. Galvanized metal.
 - 6. Exterior cement fiber siding and trim
- B. Related Requirements:
 - 1. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

- 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

2 PART - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Behr Process Corporation.
 - 2. Benjamin Moore & Co.
 - 3. Benjamin Moore & Co. (Canada).
 - 4. Bennette Paint Manufacturing Company, Inc.
 - 5. Betonel Ltd.
 - 6. BLP Mobile Paint Manufacturing.
 - 7. California Paints.
 - 8. Cloverdale Paint.
 - 9. Color Wheel Paints & Coatings.
 - 10. Columbia Paint & Coatings.
 - 11. Conco Paints.
 - 12. Coronado Paint.
 - 13. Davis Paint Company.
 - 14. Del Technical Coatings.
 - 15. Diamond Vogel Paints.
 - 16. Dunn-Edwards Corporation.
 - 17. Durant Performance Coatings.
 - 18. Duron, Inc.
 - 19. Envirocoatings Canada Inc.
 - 20. Euclid Chemical Company.
 - 21. Farrell-Calhoun.
 - 22. Frazee Paint.
 - 23. General Paint.
 - 24. Hallman Lindsay Paints.
 - 25. Hirshfield's, Inc.
 - 26. ICI Paints.
 - 27. ICI Paints (Canada).

28. Insl-x.
29. Kelly-Moore Paints.
30. Kwal Paint.
31. Life Paint Corp.
32. M.A.B. Paints.
33. Microblend Technologies Inc.
34. Miller Paint.
35. Mills Paint.
36. PARA Paints.
37. Parex LaHabra Inc.
38. Parker Paint Mfg. Co. Inc.
39. PPG Architectural Finishes, Inc.
40. Pratt & Lambert.
41. Rodda Paint Co.
42. Scott Paint.
43. Sherwin-Williams Company (The).
44. Sico, Inc.
45. Vista Paint.
46. Zinsser.

- B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: As selected by Architect from manufacturer's full range.
1. 30 percent of surface area will be painted with deep tones.

2.3 BLOCK FILLERS

- A. Block Filler, Latex, Interior/Exterior: MPI #4.
1. Sherwin Williams; Loxon Concrete and Masonry Primers.

2.4 PRIMERS/SEALERS

- A. Primer, Alkali Resistant, Water Based: MPI #3.
 - 1. Sherwin Williams; Pro Industrial Pro Cryl.
- B. Primer, Bonding, Water Based: MPI #17.
 - 1. Sherwin Williams; Multipurpose Latex Primer.

2.5 METAL PRIMERS

- A. Primer, Alkyd, Anti-Corrosive for Metal: MPI #79.
 - 1. Sherwin Williams; Multipurpose Oil Based Primer.
- B. Primer, Alkyd, Quick Dry, for Metal: MPI #76.
 - 1. Sherwin Williams; Fast Drying Primer.
- C. Primer, Galvanized: As recommended in writing by topcoat manufacturer.

2.6 WATER-BASED PAINTS

- A. Latex, Exterior Flat (Gloss Level 1): MPI #10.
 - 1. Sherwin Williams; Duration Exterior Acrylic.
- B. Latex, Exterior Semi-Gloss (Gloss Level 5): MPI #11.
 - 1. Sherwin Williams; Duration Exterior Acrylic.

2.7 FLOOR COATINGS

- A. Sealer, Water Based, for Concrete Floors: MPI #99.

2.8 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 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, the two paints are incompatible.

PART - EXECUTION

2.9 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Portland Cement Plaster: 12 percent.
 - 5. Gypsum Board: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

2.10 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
 - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

2.11 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.
 - 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.

2.12 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

2.13 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

2.14 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex System:

- a. Prime Coat: Latex, exterior, matching topcoat.
- b. Prime Coat: Primer, alkali resistant, water based, MPI #3.
- c. Intermediate Coat: Latex, exterior, matching topcoat.
- d. Topcoat: Latex, exterior flat (Gloss Level 1), MPI #10.
- e. Topcoat: Latex, exterior, low sheen (Gloss Level 3-4), MPI #15.
- f. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.
- g. Topcoat: Latex, exterior gloss (Gloss Level 6), MPI #119.

B. Steel Substrates:

1. Water-Based Coating System:

- a. Prime Coat: Primer, alkyd, anti-corrosive for metal, MPI #79.
- b. Topcoat: Light industrial coating, exterior, water based, semi-gloss (Gloss Level 5), MPI #163.

C. Galvanized-Metal Substrates:

1. Latex System:

- a. Prime Coat: Primer, galvanized metal, as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated.
- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Topcoat: Latex, exterior flat (Gloss Level 1), MPI #10.
- d. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.

D. Wood and Fiber Cement siding and trim

1. Latex System

- a. Prime Coat: Latex, exterior, matching topcoat.
- b. Prime Coat: Primer, Latex, water based, MPI #6.
- c. Intermediate Coat: Latex, exterior, matching topcoat.
- d. Topcoat: Latex, exterior flat (Gloss Level 1), MPI #10.
- e. Topcoat: Latex, exterior, low sheen (Gloss Level 3-4), MPI #15.
- f. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

1PART - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.

- 1. Concrete.
- 2. Clay masonry.
- 3. Concrete masonry units (CMU).
- 4. Steel.
- 5. Galvanized metal.
- 6. Wood.
- 7. Gypsum board.

B. Related Requirements:

- 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
- 2. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. LEED Submittals:

1. Product Data for Credit EQ 4.2: For paints and coatings, including printed statement of VOC content.
2. Laboratory Test Reports for Credit EQ 4: For paints and coatings, documentation indicating that they meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Samples for Initial Selection: For each type of topcoat product.

D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. 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.

E. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

- a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
- a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
- 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

2PART - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
- 1. Behr Process Corporation.
 - 2. Benjamin Moore & Co.
 - 3. Benjamin Moore & Co. (Canada).
 - 4. Bennette Paint Manufacturing Company, Inc.
 - 5. Betonel Ltd.
 - 6. BLP Mobile Paint Manufacturing.
 - 7. California Paints.
 - 8. Cloverdale Paint.
 - 9. Color Wheel Paints & Coatings.
 - 10. Columbia Paint & Coatings.
 - 11. Conco Paints.
 - 12. Coronado Paint.
 - 13. Davis Paint Company.

14. Diamond Vogel Paints.
15. Dunn-Edwards Corporation.
16. Durant Performance Coatings.
17. Duron, Inc.
18. Envirocoatings Canada Inc.
19. Euclid Chemical Company.
20. Farrell-Calhoun.
21. Frazee Paint.
22. General Paint.
23. Hallman Lindsay Paints.
24. Hirshfield's, Inc.
25. ICI Paints.
26. ICI Paints (Canada).
27. Insl-x.
28. Kelly-Moore Paints.
29. Kwal Paint.
30. M.A.B. Paints.
31. McCormick Paints.
32. Microblend Technologies Inc.
33. Miller Paint.
34. Mills Paint.
35. PARA Paints.
36. Parex LaHabra Inc.
37. Parker Paint Mfg. Co. Inc.
38. PPG Architectural Finishes, Inc.
39. Pratt & Lambert.
40. Rodda Paint Co.
41. Scott Paint.
42. Sherwin-Williams Company (The).
43. Sico, Inc.
44. Southern Diversified Products, LLC.
45. Smith Paint Products.
46. Vista Paint.
47. Zinsser.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of

colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

D. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Colors: As selected by Architect from manufacturer's full range.

1. 50 percent of surface area will be painted with deep tones.

2.3 BLOCK FILLERS

A. Block Filler, Latex, Interior/Exterior: MPI #4.

2.4 PRIMERS/SEALERS

A. Primer Sealer, Latex, Interior: MPI #50.

B. Primer, Latex, for Interior Wood: MPI #39.

C. Primer, Bonding, Water Based: MPI #17.

2.5 METAL PRIMERS

A. Primer, Rust-Inhibitive, Water Based: MPI #107.

B. Primer, Alkyd, Quick Dry, for Metal: MPI #76.

C. Primer, Galvanized, Water Based: MPI #134.

2.6 WATER-BASED PAINTS

A. Latex, Interior, Flat, (Gloss Level 1): MPI #53.

B. Latex, Interior, (Gloss Level 2): MPI #44.

- C. Latex, Interior, (Gloss Level 3): MPI #52.
- D. Latex, Interior, (Gloss Level 4): MPI #43.
- E. Latex, Interior, Semi-Gloss, (Gloss Level 5): MPI #54.

2.7 FLOOR COATINGS

- A. Sealer, Water Based, for Concrete Floors: MPI #99.

2.8 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings 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, the two paints are incompatible.

3PART - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Concrete: 12 percent.
 2. Masonry (Clay and CMU): 12 percent.
 3. Wood: 15 percent.
 4. Gypsum Board: 12 percent.
 5. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

F. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

G. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."
3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. 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. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Plastic conduit.
 - f. Tanks that do not have factory-applied final finishes.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:

1. Latex System:
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - b. Prime Coat: Latex, interior, matching topcoat.
 - c. Intermediate Coat: Latex, interior, matching topcoat.
 - d. Topcoat: Latex, interior, (Gloss Level 4), MPI #43.

- B. Concrete Substrates, Traffic Surfaces:

1. Water-Based Clear Sealer System:
 - a. First Coat: Sealer, water based, for concrete floors, MPI #99.
 - b. Topcoat: Sealer, water based, for concrete floors, MPI #99.

- C. Clay-Masonry Substrates:

1. Latex System:

- a. Prime Coat: Latex, interior, matching topcoat.
- b. Intermediate Coat: Latex, interior, matching topcoat.
- c. Topcoat: Latex, interior, (Gloss Level 3), MPI #52.

D. CMU Substrates:

1. Latex System:

- a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
- b. Intermediate Coat: Latex, interior, matching topcoat.
- c. Topcoat: Latex, interior, (Gloss Level 4), MPI #43.

E. Steel Substrates:

1. Latex over Alkyd Primer System:

- a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79 or primer, alkyd, quick dry, for metal, MPI #76.
- b. Prime Coat: Shop primer specified in Section 051200 "Structural Steel Framing" where substrate is specified.
- c. Intermediate Coat: Latex, interior, matching topcoat.
- d. Topcoat: Latex, interior, flat, (Gloss Level 1), MPI #53.
- e. Topcoat: Latex, interior, (Gloss Level 2), MPI #44.
- f. Topcoat: Latex, interior, (Gloss Level 3), MPI #52.
- g. Topcoat: Latex, interior, (Gloss Level 4), MPI #43.
- h. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5), MPI #54.
- i. Topcoat: Latex, interior, gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees), MPI #114.

F. Galvanized-Metal Substrates:

1. Latex over Waterborne Primer System:

- a. Prime Coat: Primer, galvanized, water based, MPI #134.
- b. Intermediate Coat: Latex, interior, matching topcoat.
- c. Topcoat: Latex, interior, (Gloss Level 4), MPI #43.
- d. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5), MPI #54.

G. Wood Substrates: Including wood trim, architectural woodwork and wood-based panel products.

1. Latex System:

- a. Prime Coat: Primer, latex, for interior wood, MPI #39.
- b. Intermediate Coat: Latex, interior, matching topcoat.
- c. Topcoat: Latex, interior, (Gloss Level 4), MPI #43.
- d. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5), MPI #54.

2. Latex over Alkyd Primer System:

- a. Prime Coat: Primer sealer, alkyd, interior, MPI #45.
- b. Intermediate Coat: Latex, interior, matching topcoat.
- c. Topcoat: Latex, interior, (Gloss Level 4), MPI #43.
- d. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5), MPI #54.

H. Gypsum Board Substrates:

1. Latex System:

- a. Prime Coat: Primer sealer, latex, interior, MPI #50.
- b. Intermediate Coat: Latex, interior, matching topcoat.
- c. Topcoat: Latex, interior, flat, (Gloss Level 1), MPI #53.
- d. Topcoat: Latex, interior, (Gloss Level 3), MPI #52.
- e. Topcoat: Latex, interior, (Gloss Level 4), MPI #43.

END OF SECTION 099123

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

- 1. Plaques.
- 2. Panel signs.

1.3 DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.4 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. MP Plastic.
- D. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:

- 1. Panel Signs: Not less than 12 inches 305 mm square including border.
- E. Sign Schedule: Use same designations indicated on Drawings.
- F. Warranty: Special warranty specified in this Section.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.

1.7 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 metal and polymer 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 MATERIALS

- A. Manufacturer's standard MP Plastic.
- B. Bronze Casting: ASTM B 584, Alloy UNS No. C86500 (No. 1 manganese bronze.)

2.2 PLAQUES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Advance Corporation; Braille-Tac Division.
 - 2. A.R.K Ramos.
 - 3. Gemini Incorporated.
 - 4. Matthews International Corporation; Bronze Division.
 - 5. Metal Art; Div. of L&H Mfg. Co.
 - 6. Mills Manufacturing Company.
 - 7. Nelson-Harkins Industries.
 - 8. Southwell Company (The).
- B. Cast Plaques: Provide castings free of pits, scale, sand holes, and other defects, as follows:
 - 1. Plaques Material: Bronze
 - 2. Background Texture: Manufacturer's standard pebble texture.
 - 3. Border Style: Projected bevel.
 - 4. Mounting: Concealed studs for substrates encountered
- C. Plaque Schedule:
 - 1. Plaque Type:
 - a. Plaque Size: 16" x 30."
 - b. Character Size: To Be Determined
 - c. Text/Message: To Be Supplied by the Owner.
 - d. Location: To Be Determined.
 - e. Quantity: 1

2.3 PANEL SIGNS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: HC 300 ADA System.:
 - 1. ACE Sign Systems, Inc.
 - 2. Advance Corporation; Braille-Tac Division.
 - 3. Allen Industries Architectural Signage
 - 4. Allenite Signs; Allen Marking Products, Inc.
 - 5. APCO Graphics, Inc.
 - 6. ASI-Modulex, Inc.

7. Best Sign Systems Inc.
8. Bunting Graphics, Inc.
9. Fossil Industries, Inc.
10. Gemini Incorporated.
11. Grimco, Inc.
12. Innerface Sign Systems, Inc.
13. InPro Corporation
14. Matthews International Corporation; Bronze Division.
15. Mills Manufacturing Company.
16. Mohawk Sign Systems.
17. Nelson-Harkins Industries.
18. Seton Identification Products.
19. Signature Signs, Incorporated.
20. Supersine Company (The)

C. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch 1.5 mm measured diagonally from corner to corner, complying with the following requirements:

1. Laminated, Sandblasted Polymer: Raised graphics with Braille 1/32 inch 0.8 mm above surface with contrasting colors and laminated to acrylic back.
2. Edge Condition: Beveled.
3. Corner Condition: Raised Border Rounded to radius indicated.
4. Mounting: Unframed.
 - a. Manufacturer's standard anchors for substrates encountered.
5. Custom Paint Colors: Match Pantone color matching system.
6. Color Background: Color to be selected by Architect from manufacturer's full range of colors.
7. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch 0.8 mm above surface with contrasting colors; Raised letters 950 White; Border 950 White; Braille 950 White.

2.4 ACCESSORIES

- A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.5 FABRICATION

- A. General: Provide manufacturer's standard signs of configurations indicated.

1. 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.
2. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.6 FINISHES, GENERAL

- 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.

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 items, including anchor inserts, are sized and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate signs and accessories where indicated, 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. Interior Wall Signs: 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 (75 mm) of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.

1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
2. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 101400

SECTION 101419 - POST AND ACRYLIC PANEL SIGNS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the following:

- 1. Post and Acrylic.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each sign type.
- B. Shop Drawings: Include individual sign types, graphics, typestyles, colors, sign dimensions and profiles. Show mounting methods, locations, accessories and installation guidelines.
- C. Samples: Provide a single unit sample of each sign type to verify colors, dimensions, profiles, finishes, method of installation and quality.
- D. Sustainable Design Data: Provide data related to materials, processes and disposition of unused material substantiating sustainable sign manufacturing.
 - 1. Recycled Content: For all manufactured sign product materials, indicate 40% of post-industrial recycled material content.
 - 2. Locally Manufactured: For all manufactured sign product materials, indicate if manufacturing location of product is within 500 miles of the project site.
 - 3. Low Emitting Materials: For all manufactured sign product material finishes, indicate the Volatile Organic Compound (VOC) limits in grams / liter or pounds / gallon.
 - a. All painted products shall contain a rating of no more than a 3.5 Volatile Organic Compound (VOC) content or 420 grams / liter.
 - 4. Waste: For all manufactured sign product materials, indicate (%) biodegradability and method of disposal of all unused sign product materials.
 - 5. Air Quality: For all manufactured sign products material finishes, provide copy of Volatile Organic Compound (VOC) reporting forms and Air Quality Permit certificate.

1.4 QUALITY ASSURANCE

- A. Manufacturers: Sign Manufacturer shall not have less than ten (10) years experience manufacturing architectural and Americans with Disabilities Act (ADA) signs of the type specified herein.
 - 1. Manufacturing lead-time for product delivered to site must not exceed four (4) weeks from receipt or order.
- B. Installers: Sign installers shall be specialized and experienced in work similar to that required for this project and provide required mounting accessories, fittings, fasteners and installation guidelines unless otherwise specified.
- C. Single Source Responsibility: Sign types specified in this section shall be obtained from a single source manufacturer and ready to install.
- D. Regulatory Requirements: Signs shall comply with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and with state building code provisions as adopted by any regulatory authority having jurisdiction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Kroy Sign Systems LLC, 7575 E. Redfield Rd., Ste 113, Scottsdale, Arizona, 85260; Telephone (800) 950-5769; Fax (800) 916-3212; Web: www.kroysignsystems.com; Email: signs@kroy.com
- B. Basis of Design Product: Kroy Sign Systems Acrylic/Aluminum Advantage Signs or approved equal. Other manufacturers must submit sign sample prior to the bid date to be considered an approved equal.

2.2 MATERIALS

- A. General: Provide acrylic panel signs and aluminum sign posts that comply with requirements indicated for materials, thickness, colors, designs, shapes, sizes and details of construction.
 - 1. Produce panel signs to comply with the applicable provisions of the ADA Accessibility Guidelines and ICC / ANSI A117.1 / 98 standards including, but not limited to, 0.031" raised pictograms, text and Grade II Braille characters.
 - 2. Panel signs shall be constructed to remain flat under installed conditions and within tolerance of plus or minus 0.015" when measured diagonally.
 - 3. Provide aluminum sign assembly post and cap for sign panel accent and installation to flat wall surfaces.
- B. Acrylic Panel Signs: Manufacturer's standard product and as follows:
 - 1. Acrylic panel signs shall be fabricated from the manufacturer's list of applicable acrylic sign materials.

- a. Gloss or non-glare clear acrylic. Select from base thicknesses of (0.125") or (0.25") inch. Material will be single piece construction and moisture resistant for interior sign applications. Specify (clear) or (surface) or (subsurface) painted material finish.
2. Panel signs shall include (two) or (four) 0.625" diameter (satin aluminum) or painted (specify color) sign posts for installation with corresponding 0.50" thick barrel for spacing and 0.187" thick post cap for sign panel faceplate accent.
3. Panel signs shall be precision laser, CNC router or saw cut to achieve dimensional shapes and sizes as specified or selected from the manufacturer's list of standard sizes.
4. Panel signs shall be clear painted using an acrylic polyurethane of consistent and uniform color.
5. Panel colors shall be selected from the manufacturer's list of standard colors.
6. Panel sign sizes shall be selected from the manufacturer's list of standard panel sizes unless otherwise specified.
7. Acrylic panel faceplate and backplate materials shall be finished with smooth edges and polished to conform to manufacturer's standard requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine wall surfaces, substrate areas and conditions with the Installer present, for compliance with the requirements for installation guidelines, tolerances and other conditions affecting the performance of work.
- B. Verify that items including anchor inserts and electrical power provided under other sections of work are sized and located to accommodate the non-illuminated directory signs.
- C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with the authorities having jurisdiction and are free from dirt and other deleterious matter.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
 1. Install signs level, plumb, and at heights indicated by ADA standards, with sign surfaces free from distortion and other defects in appearance.

2. Interior Wall Signs: 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 the door.
- B. Sign Information: Sign and or room names may change. Owner to provide final names. Provide shop submittal.

All the bunk rooms, Offices, Conference rooms, Break-out Rooms, ADA and other restrooms, Exits, Kitchen, Utility Rooms, IT rooms, Janitors Colsets

Provide no smoking signs on the exterior of the building to read:

"NO SMOKING 25' From the Building Perimeter"

- B. Wall Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated.
1. Mechanical Fasteners: Use manufacturer's standard fittings, hardware and spacers placed through predrilled holes in the sign panels. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended by the sign manufacturer.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by owner.

END OF SECTION

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Underlavatory guards.
 - 3. Custodial accessories.

1.3 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

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

1.7 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES – See drawings as well as technical specifications for the selected accessories and locations.

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Toilet Tissue (Roll) Dispenser:
 - 1. Description: Multi-Roll Toilet Tissue Dispenser.
 - 2. Mounting: Surface mounted.
 - 3. Operation: Spindleless with tension-spring controlled delivery.
 - 4. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
 - 5. Material and Finish: Chrome-plated steel.
- C. Combination Towel (Folded) Dispenser/Waste Receptacle:
 - 1. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
 - 2. Mounting: Recessed.
 - a. Designed for nominal 5-inch (150-mm) wall depth.
 - 3. Minimum Towel-Dispenser Capacity: 400 C-fold or 700 multifold paper towels.
 - 4. Minimum Waste-Receptacle Capacity: 4.9 gal. (22 L).
 - 5. Material and Finish: Stainless steel, No. 4 finish (satin).
 - 6. Liner: Reusable, vinyl waste-receptacle liner.
 - 7. Lockset: Tumbler type for towel-dispenser compartment.
- D. Liquid-Soap Dispenser:
 - 1. Description: Designed for dispensing antibacterial soap in liquid or lotion form.
 - 2. Mounting: Vertically oriented, surface mounted.
 - 3. Capacity: 30 oz. (850 mL).
 - 4. Materials: Stainless steel, No. 4 finish (satin).

5. Lockset: Tumbler type.
6. Refill Indicator: Window type.

E. Grab Bar:

1. Mounting: Flanges with concealed fasteners.
2. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
3. Outside Diameter: 1-1/2 inches (38 mm).
4. Configuration and Length: As indicated on Drawings.

F. Sanitary-Napkin Disposal Unit:

1. Mounting: Surface mounted.
2. Capacity: 1.0 gal (3.8L)
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

G. Mirror Unit:

1. Frame: Stainless-steel angle, 0.05 inch (1.3 mm) thick.
 - a. Corners: Welded and ground smooth.
2. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
3. Size: As indicated on Drawings.

H. Coat Hook:

1. Description: Single-prong unit.
2. Material and Finish: Stainless steel, No. 4 finish (satin).

2.2 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded plastic, white.

2.3 CUSTODIAL ACCESSORIES

- A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.
- B. Mop and Broom Holder:
 - 1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
 - 2. Length: 36 inches (914 mm).
 - 3. Hooks: Four.
 - 4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
 - 5. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
 - b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

2.4 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. 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.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.5 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

SECTION 104413 - FIRE EXTINGUISHER CABINETS

1PART - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fire protection cabinets and mounting brackets for the following:
 - a. Portable fire extinguishers.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function.
- D. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

FIRE EXTINGUISHER CABINETS	104413 - 1
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- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire protection cabinets with wall depths.

2 PART - PRODUCTS

2.1 MATERIALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
 - 1. Sheet: ASTM B 209 (ASTM B 209M).
 - 2. Extruded Shapes: ASTM B 221 (ASTM B 221M).
- B. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

2.2 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. Kidde Residential and Commercial Division, Subsidiary of Kidde plc;.
 - d. Larsen's Manufacturing Company; Basis of Design - 2409 - 6R.
 - e. Modern Metal Products, Division of Technico Inc.;.
 - f. Moon-American;.
 - g. Potter Roemer LLC;.
 - h. Watrous Division, American Specialties, Inc.;.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Aluminum sheet.

FIRE EXTINGUISHER CABINETS	104413 - 2
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1. Shelf: Same metal and finish as cabinet.
- D. Semirecessed Cabinet: 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 (64-mm) backbend depth.
- E. Cabinet Trim Material: Aluminum sheet.
- F. Door Material: Aluminum sheet.
- G. Door Style: Fully glazed panel with frame.
- H. Door Glazing: Acrylic sheet.
1. Acrylic Sheet Color: Clear transparent acrylic sheet.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
1. Provide manufacturer's standard.
 2. Provide manufacturer's standard hinge permitting door to open 180 degrees.
- J. Accessories:
1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
 3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
- K. Finishes:
- a. Interior of cabinet and door.
 2. Aluminum: Clear anodic.
- 2.3 FABRICATION

FIRE EXTINGUISHER CABINETS	104413 - 3
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- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Provide factory-drilled mounting holes.
 - 3. Prepare doors and frames to receive locks.
 - 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
 - 2. Fabricate door frames of one-piece construction with edges flanged.
 - 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "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.

2.5 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

3 PART - EXECUTION

3.1 EXAMINATION

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

FIRE EXTINGUISHER CABINETS	104413 - 4
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3.2 INSTALLATION

A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:

1. Fire Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.

3.3 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - b. Kidde Residential and Commercial Division.
 - c. Larsens Manufacturing Company.
 - 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
 - 3. Valves: Manufacturer's standard.
 - 4. Handles and Levers: Manufacturer's standard.
 - 5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb (2.3-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated finish.
 - 1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

- a. Orientation: Vertical.

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: Top of fire extinguisher to be at 42 inches (1067 mm) above finished floor.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 107529 - PLAZA-MOUNTED FLAGPOLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes plaza-mounted flagpoles made from aluminum
- B. Owner-Furnished Material: Flags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
- B. Shop Drawings: For flagpoles.
 - 1. Include plans, elevations, foundation, foundation details, and attachments to other work. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
 - 2. Include details of plaza-mounted connections and mountings.
- C. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.
- D. Delegated-Design Submittal: For flagpoles.
 - 1. Include loads, point reactions, and locations for attachment of flagpoles to building's structure.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.5 COORDINATION

- A. Coordinate installation of anchorages for flagpoles. Furnish setting drawings, templates, and directions for installing anchorages that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design flagpole assemblies.
- B. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.
 - 1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location is noted on the Structural Notes.
 - 2. Base flagpole design on polyester, nylon or cotton flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2.3 ALUMINUM FLAGPOLES

- A. Aluminum Flagpoles: Cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B241/B241M, Alloy 6063, with a minimum wall thickness of 3/16 inch (4.8 mm).
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Tapered Aluminum Flagpole by The Liberty Flagpole Company or comparable product by one of the following:
 - a. Flagpoles Etc.
 - b. Atlantic Flagpole
- B. Exposed Height: 35 feet (11 m)

- C. Construct flagpoles in one piece.
- D. Cast-Metal Shoe Base: Made from aluminum with same finish and color as flagpoles for anchor-bolt mounting; furnish with anchor bolts.

2.4 FITTINGS

- A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
 - 1. 0.063-inch (1.6-mm) spun aluminum, finished to match flagpole.
- B. External Halyard: Ball-bearing, nonfouling, revolving truck assembly of cast metal with continuous 5/16-inch- (8-mm-) diameter, braided polypropylene halyard and 9-inch (228-mm) cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.
 - 1. Halyards and Cleats: One at each flagpole.
 - 2. Halyard Flag Snaps: Chromium-plated bronze swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.
 - 3. Plastic Halyard Flag Clips: Made from injection-molded, UV-stabilized, acetal resin (Delrin). Clips attach to flag and have two eyes for inserting both runs of halyards. Furnish two per halyard.

2.5 MISCELLANEOUS MATERIALS

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.
- B. Elastomeric Joint Sealant: Multicomponent nonsag urethane joint sealant complying with requirements in Section 079200 "Joint Sealants."
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41 AA-M12C22A31.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 FLAGPOLE INSTALLATION

- A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.
- B. Baseplate: Install baseplate on washers placed over leveling nuts on bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.
- C. Mounting Brackets and Bases: Anchor brackets and bases securely to structural support with fasteners as indicated on Shop Drawings.

END OF SECTION 107529

Quote

MAYS-MUNROE
& the sleep center
 THE ONLY NAME YOU NEED TO KNOW!

MAYS-MUNROE/ SLEEP CENTER-00
 (850) 385-9495, 224-1231
 2791 CAPITAL CIRCLE NE
 TALLAHASSEE, FL 32308

5323



Quote Date: 03/24/2026

Date Desired: N/A

Sales Associate: Ellen Munroe

Job Name: N/A

Exp Date: 04/23/2026

Customer PO: N/A

Job #: N/A

Permit #: N/A

Next Call: N/A

SECTION 113000 APPLIANCES

Sold To: 83772 Franklin County Emergency Operation Center 28 Airport Rd Apalachicola, FL 32320-1204 (850) 653-8977 ering@franklincountyflorida.org,...			Ship To: 83772 Franklin County Emergency Operation Center 28 Airport Rd Apalachicola, FL 32320-1204 (850) 653-8977 ering@franklincountyflorida.org,...	WHSE NOTES Customer to provide Approved venting.	DELIVERY NOTES		
#	Brand	Model Number	Description		Unit Price	Qty	Ext. Price
1	Thermador	THBPRG486WDG...	Stainless steel -Gas Professional Range, 48" Pro Grand® Commercial Depth: Main kitchen		\$12,699.00	1	\$12,699.00
2	Thermador	PALPKITGA	Not Applicable -installation accessory: Main kitchen		\$199.00	1	\$199.00
3	Thermador	PA12LCVRW	Not Applicable -Cover: Griddle: Kitchen		\$209.00	1	\$209.00
4	Thermador	THBT36IF905SP	Panel-Ready -BLDR VERSION Freedom®, Built-in Freezer Column, 36", Panel Ready: Main Kitchen		\$5,999.00	1	\$5,999.00
5	Thermador	THBPR36HNDL20..	BLDR VERSION Handle: Main Kitchen		\$125.00	1	\$125.00
6	Thermador	THBTFL36IR900	BLDR VERSION Door panel: Main Kitchen		\$799.00	1	\$799.00
7	Thermador	THBT36IR905SP	Panel-Ready -BLDR VERSION Freedom®, Built-in Refrigerator Column, 36", Panel Ready: Main Kitchen		\$5,999.00	1	\$5,999.00
8	Thermador	THBPR36HNDL20..	BLDR VERSION Handle: Main Kitchen		\$129.00	1	\$129.00
9	Thermador	THBTFL36IR900	BLDR VERSION Door panel: Main Kitchen		\$799.00	1	\$799.00
10	Bosch	SGX78C55UC	Stainless Steel -800 Series, Dishwasher, 24", Stainless steel: Main kitchen		\$1,299.00	1	\$1,299.00
11	Various Legacy Appliance Brands	DW-ELBOW	3/8" X 3/4" DISHWASHER ELBOW: Main kitchen		\$10.00	1	\$10.00
12	Gladiator	GAFZ30FDGB	Black -17.8 Cu. Ft. Upright Freezer: Pantry		\$1,799.99	1	\$1,799.99
13	Whirlpool	GARF30FDGB	WP GLADIATOR ALL REFRIG BLK: Pantry		\$1,299.00	1	\$1,299.00
14	LG	LRFLC2706S	Print Proof Stainless Steel -27 cu. ft. Smart Counter-Depth MAX French Door Refrigerator: Corridor		\$3,519.00	1	\$3,519.00
15	GE	GCSH22U1WSS	Stainless Steel -GE® 2.2 Cu. Ft. Capacity Countertop Microwave Oven: Main Kitchen		\$359.00	1	\$359.00
16	GE	GCSH22U1WSS	Stainless Steel -GE® 2.2 Cu. Ft. Capacity Countertop Microwave Oven: Corridor		\$359.00	1	\$359.00
17	LG	WKEX200HWA	White -Single Unit Front Load LG WashTower with Center Control 4.5 cu. ft. Washer and 7.4 cu. ft. Electric Dryer		\$1,899.00	2	\$3,798.00

#	Brand	Model Number	Description	Unit Price	Qty	Ext. Price
18	Various Legacy Appliance Brands	TJ75SSFFB	SS WASHER - 2PK-4FT: Laundry room area	\$30.00	2	\$60.00
19	Various Legacy Appliance Brands	CRDRY-46	6FT 4PR DRYER CORD: Laundry room area	\$30.00	2	\$60.00
20	Various Legacy Appliance Brands	VENTHOSE	VENT HOSE: Laundry room area	\$10.00	2	\$20.00
21	Various Legacy Appliance Brands	VENT CLAMPS	VENT CLAMP: Laundry room area	\$2.00	4	\$8.00
22	LABOR {LAB}	INSTALLATION	INSTALLATION: BUILT IN REFRIGERATION, DISHWASHER	\$2,500.00	1	\$2,500.00

I _____ agree to the terms and conditions

SubTotal	\$42,047.99
Sales Tax 7.5%	\$2,966.18
Sales Total	\$45,014.17

SECTION 122413 – Manual Roller Shade

Part I – GENERAL

A. SUMMARY

1. Section Includes
 - a. RB 500 Roller Shade
2. Related Work includes the following
 - b. Section 06100 Rough Carpentry
 - c. Section 08520 Aluminum Windows
 - d. Section 079200 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

B. REFERENCES

1. National Fire Protection Association (NFPA) 701
2. Department of Transportation Motor Vehicle Safety Standard 302 Flammability of Interior Materials
3. California Administrative Code Title 19
4. Federal Standard 191 Method 5903 (used by Port Authority of New York and New Jersey for drapery, curtain, and upholstery material)
5. Boston Fire Department Test BFD IX-1
6. New York State Uniform Fire Prevention and Building Code

C. SUBMITTALS

1. Subject under provisions of Section 01330 – Submittal Procedures
2. Product Data: Manufacturer's data sheets shall be submitted for each product specified, including:
 - a. Preparation instructions and recommendations
 - b. Finishes, material descriptions, dimensions of individual components
 - c. Construction and installation instructions
 - d. Manufacturers recommendations for maintenance and cleaning
3. Drawings and Diagrams: Product details, installation details, working and assembly drawings shall be supplied as requested
4. Sample: Responsible contracting officer or agent shall supply one sample shade of each type specified in this contract for approval. Supplied units shall be furnished complete with all required components, mounting and associated hardware, instructions and warranty.
5. Electric shade motors shall comply with UL standards. Copy of compliance available for submission upon request.

D. QUALITY ASSURANCE

1. Supplier: Manufacturer, subsidiary, or licensed agent shall be approved to supply the products specified, and to honor any claims against product presented in accordance with warranty.

2. Installer: Installer or agent shall be qualified to installed specified products by prior experience, demonstrated performance and acceptance of requirements of manufacturer, subsidiary, or licensed agent. Installer shall be responsible for an acceptable installation.
 3. Uniformity: Provide product of only one manufacturer for entire project.
 4. Mock up: Provide one (1) mock-up shade for each roller shade type/assembly specified.
- E. DELIVERY, STORAGE, AND HANDLING
1. Product shall be delivered to site in manufacturer's original packaging.
 2. Product shall be handled and stored to prevent damage to materials, finishes, and operating mechanisms.
- F. JOB CONDITIONS
1. Prior to shade installation, building shall be enclosed.
 2. Interior temperature shall be maintained between 60 degrees Fahrenheit and 90 degrees Fahrenheit during and after installation; relative humidity shall not exceed 80%. Wet work shall be complete and dry.
- G. WARRANTY
1. Provide a limited manufacturer's warranty from date of Substantial Completion covering the following periods.
 - a. Lifetime Limited Warranty on all hardware components, fabrics warrantied for 5 years by Hunter Douglas, and most fabrics warrantied for 10 years by the fabric manufacturer. Specific and custom product warranties available from manufacturer or its authorized agent.

Part II – PRODUCTS

A. ACCEPTABLE MANUFACTURER

1. Hunter Douglas Architectural Window Coverings – 13915 Danielson Street, Suite 100, Poway, CA 92064; Phone 800.727.8953 x1; Fax 800.205.9819; Website www.hunterdouglasarchitectural.com/windowcoverings; or architect approved equivalent.
2. Request for substitutions must be approved by architect minimum of 30 days prior to close of bid.
3. Find a representative: <http://www.hunterdouglasarchitectural.com/contacts/index.jsp#>

B. MANUAL RB 500 ROLLER SHADE

1. FABRICS: Inherently anti-static, flame retardant, fade and stain resistant, light filtering, room darkening, and blackout fabrics providing 0% to 20% openness, 5 oz/sq. yd to 20.70 oz/sq. yd, containing fiberglass, PVC, polyester, acrylic, vinyl laminates, cotton, and vinyl coatings (based upon fabric choice). *Finish selected by architect from manufacturer's available contract colors.*
 - a. Horizontal stabilizing battens are not required, nor will they be accepted.
2. CONTROL SYSTEMS:
 - a. CLUTCH OPERATED: Chain-driven operator capable of lifting up to 20 pounds of weight with a maximum allowable pull force of 10 pounds. Utilization of adjustment-free continuous qualified T304 stainless ball chain with 110 lbs. breaking strength for precise control, smooth operation, and ensures a uniform look. Components must be maintenance-free from adjustments or lubrication for trouble-free lifetime operation.

1. 90 pound breaking strength chains will not be accepted.
 2. Chain anchor device to be compliant with WCMA safety standard A100.1.1-2010 and must prevent the clutch system from moving the roller shade through lowering and raising if not properly installed as specified in ANSI Standard Section 6.5.2.
 - b. BOTTOM BAR: Industry standard sealed hembar with weight sewn into pocket providing for tracking adjustments and uniform look of the hanging fabric panel. Options include: RB500 Bottom Bar, Flat Bottom Bar, or Fabric Wrapped Extruded Hembar.
 - c. FASCIA: L-shaped removable aluminum extrusion valance that attaches to brackets and conceals roller shade. Fascia at the bottom enclosure must allow a maximum of 1" gap to allow fabric to come through. Exposure underneath greater than 1" is not to be accepted.
 - d. SURFACE OR CEILING-RECESSED POCKET: Extruded aluminum alloy U-shaped housing for recessed mounting in acoustical tile or drywall ceilings. 5.25" (9" for Dual Shades) x 5.25" profile with removable bottom aluminum closure. Ceiling-recessed pockets include an integrated tile support protrusion of $\frac{3}{4}$ ".
 - e. BLOCKOUT SYSTEM: Extruded aluminum side channel with concealed mounting brackets. Bottom bar with Nylon wool pile to prevent light leakage.
- C. FABRICATION
1. Shade measurements shall be accurate to within +/- 1/8" or as recommended in writing by manufacturer.
- D. FABRICS: Fabric and color to be chosen by specifier

Part III – EXECUTION

- A. Inspection
1. Subcontractor shall be responsible for inspection on site, approval of mounting surface, installation conditions, and field measurement for this work.
 2. Other interacting trades shall receive drawings of shade systems, dimensions, assembly, and installation methods from subcontractor upon request.
- B. Installation
1. Installation shall comply with manufacturer's specifications, standard and procedures as detailed on contract drawings
 2. Adequate clearance shall be provided to permit unencumbered operation of shade and hardware.
 3. Clean finish installation of dirt and finger marks. Leave work area clean and free of debris.
- C. Demonstration
1. Demonstrate operation method and instruct owner's personnel in the proper operation and maintenance of the roller shades.
- D. Schedule
1. Exterior Windows
 2. Interior Relights

END OF SECTION 122413

SECTION 123623 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes plastic-laminate-clad countertops.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: For plastic-laminate-clad countertops.
 - 1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
 - 2. Show locations and sizes of cutouts and holes for items installed in plastic-laminate-clad countertops.
 - 3. Apply AWI Quality Certification Program label to Shop Drawings.
- B. Samples for Initial Selection: For plastic laminates.
- C. Samples for Verification: As follows:
 - 1. Plastic Laminates: For each type, color, pattern, and surface finish required, 8 by 10 inches (200 by 250 mm) in size.
 - 2. Fabrication Sample: For each type and profile of countertop required, provide one sample applied to core material with specified edge material applied to one edge.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Quality Standard Compliance Certificates: AWI Quality Certification Program.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 - 1. Shop Certification: AWI's Quality Certification Program accredited participant.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.
- B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
- C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Grade: Premium.
- C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.
 - 1. Wilsonart - #8214 Phantom Charcoal – 18 Linearity
- D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from manufacturer's full range in the following categories:
 - a. Solid colors, gloss or matte finish.
 - b. Solid colors with core same color as surface, gloss or matte finish.
 - c. Wood grains, gloss or matte finish with grain running parallel to length of countertop.
 - d. Patterns, gloss or matte finish.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Core Material: Particleboard or MDF.

G. Core Thickness: .

1. Build up countertop thickness to 1-1/2 inches (38 mm) at front, back, and ends with additional layers of core material laminated to top.

H. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

I. Paper Backing: Provide paper backing on underside of countertop substrate.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

1. Wood Moisture Content: 8 to 13 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.

1. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue
2. Softwood Plywood: DOC PS 1.

2.3 ACCESSORIES

A. Wire-Management Grommets: Circular, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Outside Diameter: 2 inches (51 mm).
2. Color: Black,

2.4 MISCELLANEOUS MATERIAL

A. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch (25 mm) over base cabinets. Ease edges to radius indicated for the following:
 1. Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.
- C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 1. Notify Architect seven days in advance of the dates and times countertop fabrication will be complete.
 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended, and check measurements of assemblies against field measurements before disassembling for shipment.
- D. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. 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.
 2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
1. Secure field joints in countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches (3-mm-in-2400-mm) variation from a straight, level plane.
 2. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
 3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semiexposed surfaces.
- C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches (1220 mm) o.c. Remove protection at Substantial Completion.

END OF SECTION 123623.13

SECTION 123661 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.

- B. Related Requirements:

1. Section 064116 "Plastic Laminate Clad Architectural Cabinets" for cabinets supporting countertops.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials.

- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

- C. Samples for Initial Selection: For each type of material exposed to view.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

- A. 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.
- B. Installer Qualifications: Fabricator of countertops.
- C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.
 - 1. Build mockup of typical countertop as shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 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.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
 - 1. Bases-of-Design Product: Subject to compliance with requirements, provide Wilson Corporation; Wilson art Solid Surfacing, or comparable product by one of the following:
 - a. Avonite Surfaces
 - b. Formica Corporation
 - 2. Type: Provide Standard type
 - 3. Colors and Patterns: As selected by Architect from manufacturer's full range.
- B. Particleboard: ANSI A208.1, Grade M-2
- C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP 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: Premium
- B. Configuration:
 - 1. Front: Straight, slightly eased at top
 - 2. Backsplash: Straight, slightly eased at corner
 - 3. End Splash: Matching backsplash
- C. Countertops: 3/4-inch- (19-mm-) thick, solid surface material with front edge built up with same material.
- D. Backsplashes: 3/4-inch- (19-mm-) thick, solid surface material.
- E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
- F. Joints: Fabricate countertops without joints.
- G. Cutouts and Holes:
 - 1. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 - 2. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 - 1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
 - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
 - 1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- G. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661

SECTION 230510 - MECHANICAL REQUIREMENTS

PART 1 - GENERAL

This section applies to all Division 23 specifications and trades.

Cooperate with all other trades and install work as fast as the progress of the job will permit.

Use only mechanics skilled in the work they are to perform and have a competent representative on the job when any work is being done.

No work shall be done unless the Superintendent of the Contractor is on the job site. Work shall be properly protected, all rubbish removed promptly, and exposed work shall be carefully cleaned prior to final acceptance.

In decisions arising from discrepancies, interpretation of Drawings, and Specifications, substitutes, and other pertinent matters, the decision of the Owner's representative shall be final unless the Contractor seeks relief per the General Conditions.

QUALITY ASSURANCE

Applicable welding certifications, procedures, and testing shall comply with ANSI Standard B31.9 - Standard Code for Building Services Piping, and The American Welding Society, Welding Handbook.

Soldering and Brazing procedures for refrigerant piping shall conform to ASME/ANSI B31.5 Refrigeration Piping.

Installation of refrigeration systems shall conform to ANSI/ASHRAE 15 Safety Code for Mechanical Refrigeration.

WARRANTY

Contractor shall provide a one-year parts and labor warranty on all equipment provided on this project. Warranty shall start on the date of substantial completion. Contractor shall purchase manufacturer's warranty for all refrigeration equipment. Refer to individual Sections for additional warranty requirements.

RELATED DOCUMENTS

Work herein shall conform to all applicable laws, ordinances, codes, regulations and local utility company's rules. The general conditions and all requirements of the contract documents shall apply to all work of this section. Work shall be in accordance with the latest requirements and addendums as of the date of this specification unless otherwise noted:

NFPA 70 – 2020 National Electrical Code

NFPA 90A – 2021 Standard for the Installation of Air Conditioning and Ventilating Systems.

NFPA 90B – 2021 Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

NFPA 101 – 2021 Life Safety Code (Florida Edition)

NFPA 105 – 2019 Recommended practice for the Installation of Air Conditioning and Ventilating Systems

NFPA 170 – 2018 Fire Safety Symbols

NFPA 241 – 2019 Standard for Safeguarding Building Construction and Demolition Operations.

NFPA 252 – 2022 Standard Methods of Fire Test of Door Assemblies

ANSI-A 17.1 - Elevator Code
2023 Florida Fire Prevention Code, 8th Edition
Local Government Growth Management
Local Permit Authority Requirements
2023 Florida Building Code, 8th Edition
State of Florida, Department of Environmental Protection Rules
State of Florida, State Fire Marshal, Rules and Regulations (Rule 69A-3.012, FAC)
SMACNA, HVAC Duct Construction Standards
Americans with Disabilities Act
Florida Accessibility Code for Building Construction
Franklin County Guidelines & Requirements

DEFINITIONS

Furnish: Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar subsequent requirements.

Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, start-up and similar requirements.

Provide: Furnish and install, complete and ready for intended use.

Installer: Entity (firm or person) engaged to install work by Contractor, subcontractor or sub-subcontractor. Installers are required to be skilled experts in work they are engaged to install.

Specification Text Format: Any underscoring facilitates scan reading, no other meaning. Imperative language is directed at Contractor, unless otherwise noted.

SPECIFICATIONS AND DRAWINGS

Plans show locations of equipment and are intended to depict the general intent of the work in scope, layout and quality of workmanship. They are not intended to show in minute detail every or all accessories intended for the purpose of executing the work, but it is understood that such details are a part of this work.

Where Drawings and Specifications conflict, it shall be the responsibility of this Contractor to bring such conflict to the attention of the Architect/Engineer for clarification. If the contractor fails to bring the conflict to the Engineer's attention, the most stringent (most costly) requirements apply. All changes from the Drawings necessary to make the work conform with the building as constructed and to fit the work of other trades or to conform to the rules of authorities having jurisdiction, shall be made by the Contractor at his own expense.

Keep a record of the locations of concealed work and of any field changes in Contract Drawings and Specifications for each trade and, upon completion of the job, supply "As-Built" Drawings and Specifications showing, in pencil on sepia reproductions, any deviations from the original Drawings indicating in the Specifications each manufacturer's name underlined or inserted whose product was used on the job. These Drawings shall indicate dimensions of buried utility lines from building walls. One set of sepia reproductions of the original tracings will be furnished upon request for this purpose. Provide record documents in accordance with the General Conditions.

Where equipment is used other than manufacturers specified, the Contractor shall request approval to substitute materials and/or products in accordance with the General Conditions.

The Contractor shall lay out all the work as required by the drawings and be held responsible for damage, if any is incurred, due to incorrect layout of work. The Contractor shall establish all building

lines, benchmarks, and levels from which all trades can work, and take necessary measures to keep the marks in visible evidence throughout all stages of the work.

The Contractor shall comply with all rules and regulations of the Florida Industrial Commission, the State and Federal Departments of Commerce and Labor, EPA regulations, and the OSHA Laws, as they may apply to the work. The Contractor shall also comply with all Owner policies while on-site.

By submitting a bid for equipment other than the "Design Basis Equipment" (i.e., that which is shown on the Contract Drawings), the Contractor:

Represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified and complies with all the requirements set forth in the General Conditions;

Certifies that the cost data presented is complete and includes all related costs under this Contract but excludes costs under separate contracts, and excludes the Engineer's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent;

Will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects; and,

Certifies that the proposed equipment meets the requirements of the Contract Documents.

PERMITS, FEES, AND INSPECTIONS

The Contractor shall give all necessary notices, obtain all permits, and pay all government fees, and other costs, and file all permit applications required by all governmental departments having jurisdiction.

Obtain all required certificates of inspection for work and deliver them to the Owner before requesting acceptance and final payment for the work.

The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, and drawings required to comply with all applicable laws, ordinances, rules, and regulations.

The Contractor shall inform the Owner of any work or materials which conflict with any of the applicable codes, standards, laws, and regulations before submitting his bid.

GENERAL

Materials or products specified herein and/or indicated on drawings by trade name, manufacturer's name and/or catalog number shall be provided as specified. Substitutions will not be permitted except as described herein and in the General Conditions.

All materials shall be new and of quality as specified, and when required, be clearly labeled and/or stamped as manufactured in the United States.

A list of all materials and equipment which the Contractor proposes to furnish shall be submitted for approval within ten (10) days after the contract has been awarded. Data shall be complete in all respects.

RENOVATION WORK

Areas under renovation which are adjacent to occupied areas shall be sealed off and maintained under a negative pressure during construction. If existing exhaust fans are used then the ducts shall be cleaned after construction is complete but before final test and balance.

SHOP AND ERECTION DRAWINGS

Submit shop drawings for all components in the proposed system for review by Owner's representative before ordering or installing any equipment or material. Equipment or material ordered or installed before Owner's representative review may not be accepted and will have to be removed from the project.

Shop drawings shall consist of manufacturer's scale drawings, cuts, or catalogs, including descriptive literature which shall clearly indicate the construction, material, physical dimensions, wiring diagrams and complete operating data clearly marked for each item. Data of general nature will not be accepted.

Submit shop drawings in accordance with the General Conditions.

COORDINATION DRAWINGS

Prepare coordination drawings when alternate manufacturers are proposed of space containing air handling units, pumps, chillers, water heaters or similar large mechanical equipment detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Drawings shall be prepared at a scale of 1/4" - 1'0" or larger. Indicate locations of access and where sequencing and coordination of installations are of importance to the efficient flow of the Work.

Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:

Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance; Equipment connections and support details; Exterior wall and foundation penetrations; Fire-rated wall and floor penetrations; concrete pads and bases.

Floor plans, elevations, and details shall indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

MECHANICAL EQUIPMENT CLEARANCES

Maintain minimum three (3) feet clearance in front of mechanical equipment requiring maintenance. Pay close attention to access doors of new and existing equipment. Comply with NEC Code Clearances.

ROOF MOUNTED EQUIPMENT

All equipment installed on the roof shall be attached to the structure in a manner approved by the manufacturer and shall be capable of withstanding winds in excess of 140 mph.

ROUGH-IN

For all piping and equipment field verify final locations for rough-ins with actual field measurements and with the requirements of the actual equipment to be connected.

UNDERGROUND PIPING

Provide the Engineer with a seven (7) day notice prior to covering up any underground pipe to allow sufficient time for inspection.

EXPERIENCE

The Contractor performing this work shall be a Florida licensed, reputable firm, regularly performing the type of work incorporated in this project and who also maintains, as part of the firm, a service department with qualified personnel who regularly perform this type of work. The Contractor shall, upon request, show evidence of at least two jobs of similar scope and size either completed or under contract within the preceding two years.

ELECTRICAL WORK FOR MECHANICAL SYSTEMS

All electrical components shall be U.L. listed. All wiring components and devices shall conform to the National Electrical Code.

WIRING FOR MECHANICAL EQUIPMENT

All power wiring for mechanical equipment shall be provided by Division 26.

All control wiring for mechanical equipment shall be provided by Division 23. Control wiring shall be defined as all wiring not in the direct path of supplying power to the mechanical equipment.

MOTORS

All motors shall be built in accordance with the current applicable IEEE, ASA, and NEMA standards. All general-purpose motors shall be open drip-proof machines for installation indoors and/or in protected locations. Totally enclosed fan cooled (TEFC) motors shall be used in all areas of exposure to weather or other environmental contamination. Motors shall be rated explosion proof when located in hazardous atmospheres.

Unless indicated otherwise, motors shall be NEMA Design B with a service factor of 1.15 with total temperature rise of 50 degrees C. (resistance measured) in 40 degrees C. ambient when powered from the system voltage feeding the motor. TEFC motors shall have class F insulation and ODP motors shall have class B insulation. Motors located in areas exceeding 40° C ambient shall be factory rated for the ambient temperature of the motor environment. Single phase motors shall generally be NEMA Design N split phase induction motors with built-in thermal protectors. Single phase motors connected on loads requiring high starting torque shall be capacitor-start induction motors. Single phase motors of 1/10 HP or less shall be P-S-C motors. Inverter duty motors (with Class F Insulation) shall be provided if connected to a variable frequency drive.

Unless otherwise noted, motors supplied on this project one (1) HP and larger shall have an efficiency which meets or exceeds the efficiency shown in Tables 1 and 2, below (per FBC Energy Conservation – C405.7), tested in accordance with IEEE Standard 112, Test Method B, and shall have a power factor not less than 85 percent under rated load conditions. Power factor of less than 85 percent shall be corrected to at least 90 percent under rated load conditions. Power factor corrective devices, installed to comply with this requirement, shall be switched with the utilization equipment.

Table 1:
Minimum Nominal Full Load Efficiencies for 4 Pole (1800 RPM) Electric Motors at 60Hz

Motor Horsepower	Open Motors	Enclosed Motors
	Minimum Nominal Efficiency (%)	Minimum Nominal Efficiency (%)
1	85.5	85.5
1.5	86.5	86.5
2	86.5	86.5
3	89.5	89.5
5	89.5	89.5
7.5	91.0	91.7
10	91.7	91.7
15	93.0	92.4
20	93.0	93.0
25	93.6	93.6
30	94.1	93.6
40	94.1	94.1
50	94.5	94.5

Table 2:
Minimum Nominal Full Load Efficiencies for 2 Pole (3600 RPM) Electric Motors at 60Hz

Motor Horsepower	Open Motors	Enclosed Motors
	Minimum Nominal Efficiency (%)	Minimum Nominal Efficiency (%)
1	77.0	77.0
1.5	84.0	84.0
2	85.5	85.5
3	85.5	86.5
5	85.5	88.5
7.5	85.5	89.5
10	89.5	90.2
15	90.2	91.0
20	91.0	91.0
25	91.7	91.7
30	91.7	91.7
40	92.4	92.4
50	93.0	93.0

For Fractional HP Motor Efficiency, Refer to 2023 FBC-Energy Tables C405.7(3) and Tables C405.7(4).

REMOVAL OF RUBBISH

Contractor shall keep premises free from accumulations of waste material or rubbish caused by his employees or work. At completion of work, he shall remove all his tools, scaffolding, surplus materials, and rubbish from building and site. He shall leave premises and his work in a clean orderly condition acceptable to the Owner's representative.

QUIET OPERATION AND VIBRATION

All equipment provided under this section shall operate under all conditions of load free of abnormal sound and vibration. Sound and vibration conditions considered abnormal shall be corrected in an approved manner at no additional cost to the Owner.

EXAMINATION OF EXISTING CONDITIONS

Visit and carefully examine those portions of the site and/or present buildings affected by this work so as to become familiar with existing conditions and difficulties that will affect the execution of the work before submitting proposals.

Submission of a proposal will be construed as evidence that such examination has been made and later claims for labor, equipment, or materials required because of difficulties encountered, which could have been foreseen had such examination been made, will not be recognized.

CLEANING AND ADJUSTMENTS

Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

Clean and flush hydronic piping systems; remove, clean, and replace strainer screens. After cleaning and flushing hydronic piping system, but before balancing, remove disposable fine mesh strainers in pump suction diffusers.

Mark calibrated name plates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

Upon completion of work, Contractor shall clean and lubricate pumps, fans, motors, and other running equipment and apparatus which he has installed and make certain such apparatus and mechanisms are in proper working order and ready to test.

Scratched or damaged painting shall be touched up as necessary to return the painting to "new" condition and appearance.

All piping and equipment shall be thoroughly blown out under pressure and cleared of all foreign matter, wasting air, gas, or water through temporary connections as long as necessary to thoroughly clean system before system is placed in operation. Use every precaution to prevent pipe compound, scale, dirt, welding, and other objectionable matter from getting into the piping system and equipment.

During blow out period, baskets from strainers shall be removed, traps and control valves, etc., shall be by-passed.

All cleaning shall be done prior to any pressure testing, flow balancing or equipment adjustment procedures.

DEMOLITION

Demolition shall be as shown on drawings or specified.

Schedule all demolition work with Owner to cause minimum downtime of any building service or function. No extra cost to the contract will be allowed for overtime work unless specifically authorized in advance by representative or Owner in writing.

During demolition and construction, protect from damage all existing equipment and services that are to remain. Repair or replace any damage to existing facilities at no extra cost to the contract.

Remove with care and deliver to a location designated by representative of the Owner all items designated to remain the property of the Owner.

Drawings are diagrammatic and show only major obstructions, coordinate with other trades for removal or relocation of pipes, conduits, hangers, etc., in path of work.

No columns, beams, joists, building foundations, nor any other structural building component shall be cut, drilled, or disturbed in any way. Conflicts shall immediately be brought to the attention of the Owner's representative. Contractor shall not proceed until instructed in writing by the Owner's representative if conflicts between mechanical work and structural elements occur.

Temporary Removal: Carefully remove, store, clean, reinstall, reconnect, and make operational equipment indicated to be reused. Prior to removal Contractor shall inspect existing equipment and note any deficiencies and repairs needed. Failure to note deficiencies will require the Contractor to repair the equipment for no additional cost.

Demolish and remove inactive and obsolete piping, fittings, and specialties, equipment, ductwork, controls, fixtures, and insulation.

Piping and ducts embedded in floors, walls, and ceilings may remain if such materials do not interfere with new installations.

Demolish and remove obsolete and abandoned exposed piping and ducts to a point flush with floors and walls. Remove materials above accessible ceilings and below raised floors. Drain and cap piping and ducts allowed to remain.

CONNECTIONS TO EXISTING WORK

Plan installation of new work and connections to existing work to insure minimum interference with regular operation of existing facilities.

Submit to the Owner for approval, a schedule of necessary temporary shut-downs of existing services. All shutdowns shall be made at such times as will not interfere with regular operation of existing facilities and only after written approval of the Owner.

To ensure continuous operation, make necessary temporary connections between new and existing work.

Connect new work to existing work in neat and approved manner. Restore disturbed existing work to original condition.

After completion of project clean the exterior surface of equipment included in this section, remove all concrete residues and touch up paint or completely repaint all damaged surfaces.

STORAGE OF MATERIALS

All materials stored on site shall be in a Contractor supplied trailer or enclosure and shall be properly protected from injury or deterioration. Materials shall not be stored in contact with ground or floor.

Do not remove manufacturer's packing materials until ready to install. Materials showing signs of corrosion, improper handling or storage shall be replaced at no cost to the Owner.

During construction protect all piping and equipment from damage and dirt. Cap the open ends of all piping and equipment.

Provide continuous protection for all equipment already installed.

WATERPROOFING

Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as approved by the Owner before the work is done.

Provide all necessary sleeves, caulking and flashing required to make openings absolutely watertight. Waterproof flashing materials shall be compatible with base materials.

TESTS

Contractor shall make all tests required to establish the adequacy, quality, safety, completed status, and satisfactory operation of all systems to the satisfaction of the Owner's representative. Provide all instruments, labor, and services necessary to conduct tests.

INSTRUCTIONS

Fully instruct Owner's personnel in the care and operation of mechanical systems and furnish a letter to the Owner's representative advising the particular person who has received such instruction.

END OF SECTION 230510

SECTION 230512 – BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

SUMMARY

This Section specifies mechanical components and installation methods common to more than one section of Division 23 and shall apply to all Division 23 work as is applicable.

SUBMITTALS

Product Data: Submit manufacturer's technical product data and installation instructions for each material described in this section as is applicable. These submittals and shop drawings shall be in no less detail than the product, material and installation descriptions provided herein and on the drawings.

PART 2 - PRODUCTS

CEILING/WALL ACCESS DOORS

Steel Access Doors & Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.

Frames: 16-gage steel, with a 1-inch-wide exposed perimeter flange for units installed in unit masonry, precast, or cast-in-place concrete, ceramic tile, or wood paneling.

For installation in masonry, concrete, ceramic tile, or wood paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.

For gypsum wallboard or plaster: perforated flanges with wallboard bead.

For full-bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

Flush Panel Doors: 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.

Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

Locking Devices: Flush, screwdriver-operated cam locks.

AVAILABLE MANUFACTURERS:

Bar-Co., Inc.
J.L. Industries
Karp Associates, Inc.
Milcor Div.
Inryco, Inc.
Nystrom, Inc.

FIRE STOPS

General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.

Fire-Resistant Joint Sealers: Two-part foamed-in-place silicone sealant, intumescent putty, or one-part silicone elastomeric sealant, formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors. Sealants and accessories shall provide fire-resistance ratings to three (3) hours protection, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

ACCEPTABLE MANUFACTURERS:

3-M Corporation
Dow-Corning Corp.
General Electric Co.
Nelson Flame Seal
Fire Stop V

Submit manufacturer's technical data for each produce used and include installation instructions, and material safety data sheets.

SOIL MATERIALS

Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.

Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2-inch sieve, and not more than 5 percent passing a No. 4 sieve.

Backfill and Fill Materials: Materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP; free of clay, rock, or gravel larger than 2 inches in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

PART 3 - EXECUTION

EXAMINATION

DELIVERY, STORAGE, AND HANDLING

Deliver fire stop materials and similar type items in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

Store and handle all materials in compliance with the manufacturer's recommendations to prevent their deterioration and damage.

SEQUENCING AND SCHEDULING

Coordinate the size and location of concrete equipment pads. Cast anchor-bolt inserts into pad.

Coordinate the installation of pipe sleeves for foundation wall penetrations, etc.

Coordinate mechanical equipment locations and supports with roof work.

CONTROLS COORDINATION

The mechanical contractor shall install control valves/actuators, control dampers, damper actuators, immersion wells, pressure sensor taps, flow meters, etc. which are to be furnished by the controls contractor.

MECHANICAL EQUIPMENT NAMEPLATE DATA

Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliance, and similar essential data. Locate nameplates in an accessible location. Where equipment is insulated or otherwise concealed, nameplates shall be located so as to be visible with insulation installed.

IDENTIFICATION

Provide a complete identification system for all systems.

All equipment, valves, controls, and piping shall be identified and marked as specified below. All numbers and letters shall be manufacturer's standard block lettering. Provide a typed index of all abbreviations and numbering systems used in the identification system. Coordinate names, abbreviations and number with those used on the drawings.

Coordination: Where identification is to be applied to surfaces which require insulation, painting, or other covering of finish, including valve tags in finished mechanical spaces, install identification prior to installation of acoustical ceiling and similar removable concealment.

UNDERGROUND PIPING IDENTIFICATION

General: During back filling/top soiling of each exterior underground piping systems, install continuous underground type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker. For tile fields and similar installations, mark only edge pipelines of field.

VALVE IDENTIFICATION

General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.

Where more than one major machine room is shown for project, install mounted valve schedule in each major machine room, and repeat only main valves which are to be operated in conjunction with operations of more than one single machine room.

EQUIPMENT IDENTIFICATION

Each unit furnished shall be identified by its system number and other appropriate designation as directed by the owner. Minimum requirements include engraved plastic laminate signs (1/8" thick) permanently attached to each piece of equipment. Equipment requiring identification shall include but not be limited to: pumps, chillers, cooling towers, DX equipment controls, and other equipment

as may be directed by the Owner's representative. The contractor shall submit proposed equipment identification system with shop drawings.

PIPING IDENTIFICATION

Provide plastic pipe markers for all new piping systems using plastic pipe markers specified below.

PLASTIC PIPE MARKERS

Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded (coordinate with owner), pressure-sensitive vinyl pipe markers, complying with ANSI A13.1.

Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125°F (52°C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.

Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:

Adhesive lap joint in pipe marker overlap.

Laminated or bonded application of pipe marker to pipe (or insulation).

Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".

Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:

Laminated or bonded application of pipe marker to pipe (or insulation).

Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, tape lapped 3".

Lettering: Comply with piping system nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application length.

Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

Plastic Tape: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.

Color: Comply with ANSI A13.1, except where another color selection is indicated.

PIPING IDENTIFICATION INSTALLATION

General: Install pipe markers on each system provided and include arrows to show normal direction of flow:

Plastic pipe markers, with application system as indicated above. Install on pipe insulation segment where required for hot non-insulated pipes.

Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

Near each valve and control device.

Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.

Near locations where pipes pass through walls or floors/ceilings or enter non-accessible enclosures.

At access doors, manholes and similar access points which permit view of concealed piping.

Near major equipment items and other points of origination and termination.

Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

On piping above removable acoustical ceilings, except omit intermediately spaced markers.

UNDERGROUND-TYPE PLASTIC LINE MARKERS

General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

VALVE TAGS

Brass Valve Tags: Provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and 5/32" hole for fastener.

Provide 1-1/2" diameter tags, except as otherwise indicated.

Provide size and shape as specified or scheduled for each piping system.

Fill tag engraving with black enamel.

Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves and manufactured specifically for that purpose.

Access Panel Markers: Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hold to allow attachment.

Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.

Provide UL label on each fire-rated access door.

VALVE SCHEDULE FRAMES

General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

PLASTICIZED TAGS

General: Manufacturer's standard pre-printed or partially pre-printed accident prevention tags, of plasticized card stock with matt finish suitable for writing, approximately 3-1/4" x 5-5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

LETTERING AND GRAPHICS

General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified, or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

DUCT SYSTEM IDENTIFICATION

General: Identify air supply, return, exhaust, intake, outside air, and relief ducts with duct markers or stenciled signs and arrows, showing duct system service and direction of flow. Locate in each space where ducts are exposed and where ducts are located above accessible ceiling systems. Locate near points where duct enter the space and at maximum 50-foot intervals.

Identify the location of all fire and fire/smoke dampers. Identification tags shall be affixed to the ceiling/wall and shall be visible from the occupied space.

EQUIPMENT SUPPORTS

Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.

Grouting: Place grout under supports for piping and equipment.

CUTTING, PATCHING, EXCAVATION, BACKFILL, AND LAYOUT

Provide openings and excavation required for the installation of the work. Patch work and backfill as required. Finished work shall match the existing adjoining work.

Verify all conditions affecting the work to be performed under this contract.

Carefully verify measurements at the site, determine the exact location of chases and openings required. Provide sleeves, inserts, and hangers as required. Neither columns, beams, joists, building foundations nor any other structural building component shall be cut, drilled or disturbed in any way. Conflicts shall immediately be brought to the attention of the Owner's representative.

Any damage incurred by the Contractor shall be repaired by the Contractor in a manner approved by the Owner's representative at no cost to the Owner and with no extension of time limitation.

TRENCH SAFETY

Where trench excavation will exceed a depth of 5 feet, the contractor shall provide written assurance by the contractor performing the trench excavation that such contractor will comply with the "Trench Safety Act" (Florida Law 90-96) and OSHA Standards, 29 C.F.R. 1926.650 Subpart P. Written assurance shall be provided prior to beginning trenching work.

EXCAVATION

Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.

Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.

Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.

Install sediment and erosion control measures in accordance with local codes and ordinances.

Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.

Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.

Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.

Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.

Excavation for Underground Tanks, Basins, and Mechanical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete form work, installation of services, other construction, and for inspection.

Excavate, by hand, areas within drip line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.

Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.

Trenching: Excavate trenches for mechanical installations as follows:

Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearance on both sides of pipe and equipment.

Excavate trenches to depth indicated or required for piping to establish indicated slope and invert elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.

Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of pipe. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and pipe.

Excavate trenches for piping and equipment with bottoms of trench to accurate elevations for support of pipe and equipment on undisturbed soil.

For pipes or equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom 1/4 of the circumference. Fill unevenness with tamped sand backfill. At each pipe joint over excavate to relieve the bell or pipe joint of the pipe of loads, and to ensure continuous bearing of the pipe barrel on the bearing surface.

Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 deg F.

Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.

Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.

Under building slabs, use drainage fill materials.

Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.

For piping less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation and testing of piping, provide a 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.

Other areas, use excavated or borrowed materials.

Backfill excavations as promptly as work permits, but not until completion of the following:

Inspection, testing, approval, and locations of underground utilities have been recorded.

Removal of concrete formwork.

Removal of shoring and bracing, and backfilling of voids.

Removal of trash and debris.

Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them to approximately same elevation in each lift.

Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below (note coordinate with Civil Engineer and provide compaction as indicated or specified below whichever is greater).

Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture density relationship (cohesionless soils).

Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.

Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.

Other Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.

Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.

Subsidence: Where subsidence occurs at mechanical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, concrete, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

APPLICATION OF JOINT SEALERS

General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.

Comply with recommendations of ASTM C 790 for use of acrylic-emulsion joint sealants.

Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.

Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

Tooling: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not

use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around mechanical services penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

INSTALLATION OF ACCESS DOORS

Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.

Adjust hardware and panels after installation for proper operation.

SMOKE DETECTORS

Install smoke detectors as indicated on drawings and comply with these specifications and the manufacturer's instructions. Install in an accessible area or provide access door if installed above a hard ceiling. Smoke detectors installed prior to the air handler shall be installed in the return air duct prior to mixing with outside air. Install level so sampling tube openings are directly exposed to air flow. Coordinate the following application considerations with the Division 16 contractor who will furnish smoke detectors.

Application Considerations: Only one detector is required per location, regardless of volume of air, if:

The sampling tube extends at least 3/4 of the total width of the duct and is located approximately at the center of the vertical dimension of the duct, and there is no air inlet to the duct upstream.

If, however, there is an inlet within a distance of six duct widths upstream:

Use one detector for each four feet of vertical height (lower sampling tube located two feet above the bottom of the duct and additional sampling tubes mounted four feet on center of vertical height).

For ducts wider than 12 feet use two detectors for each position, mounted on opposite sides of the duct.

The above recommended detector limits apply to both the return air and supply air locations as required.

PAINTING/PROTECTIVE COATINGS

Prime and paint (2 coats) all ducts (except stainless steel), piping, insulation, unpainted equipment or steel, structural bases and supports provided in Division 15 and existing in the limits of construction. Paint shall be industrial grade enamel; match existing color scheme or as directed by the Owner.

Uninsulated piping, bases, supports and other unfinished steel shall be thoroughly cleaned of all rust and dirt. Apply one coat of rust inhibiting primer and two finishing coats.

Insulated piping and equipment shall receive one coat of primer and two finishing coats.

Pipe hangers, saddles and accessories shall be painted to match the piping (or existing color scheme).

Coat all underground copper pipes with bitumastic or an approved equal.

Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of a water based latex paint.

Colors for piping systems shall conform to ANSI A13.1 and ASHRAE Fundamentals, Chapter 38. Color for equipment supports and bases shall be gray.

IDENTIFICATION ADJUSTING AND CLEANING

Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

Cleaning: Clean face of identification devices and glass frames of valve charts.

COMMISSIONING

Install strainers with start-up screens: Install permanent screens after flushing and start-up is complete.

Fill the system: Check compression tanks to determine that they are not air bound and that the system is completely full of water. Sanitize domestic water systems. Perform initial chemical treatment of hydronic and systems.

Check expansion tanks to determine that they are not air bound and that the system is completely full of water.

After operating system to remove solids, remove start-up screens and provide standard screen.

Before operating the system perform these steps:

Open valves to full open position. Close coil bypass valves.

Remove and clean strainers.

Check pump for proper direction of correct improper wiring.

Set automatic fill valves for required system pressure.

Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).

Set temperature controls so all coils are calling for full flow.

Check operation of automatic bypass valves.

Install minimum 30% efficient ASHRAE filters for start-up and install all new pre and final filters prior to test and balance.

Check and set operating temperatures of chillers to design requirements.

Lubricate motors and bearings.

Close drain valve, hydrants, and hose bibbs.

Charge refrigerant systems using the following procedure:

Install core in filter dryer after leak test but before evacuation.

Evacuate refrigerant system with vacuum pump; until temperature of 35 deg F. is indicated on vacuum dehydration indicator.

During evacuation, apply heat to pockets, elbows, and low spots in piping.

Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.

Break vacuum with refrigerant gas; allow pressure to build up to 2 psi.

Complete charging of system using new filter dryer core in charging line. Provide full operating charge.

Train Owner's Maintenance Personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance of refrigerant piping valves and refrigerant piping specialties.

Review data in Operating and Maintenance Manuals. Refer to Division 1 section "Project Closeout."

Schedule training with Owner through the Architect, with at least 7 days advance notice.

END OF SECTION 230512

SECTION 230513 – ELECTRICAL REQUIREMENTS FOR MECHANICAL SYSTEMS

PART 1 – GENERAL

RELATED DOCUMENTS

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

Related Sections: Other separate electrical components and materials required for field installation and electrical connections are specified in Division 26. Refer to other sections of Division 23 specifications for related work or requirements.

SUMMARY

This section specifies the basic requirements for electrical components which are an integral part of packaged mechanical equipment or are separate electrical components provided for mechanical equipment. These components include, but are not limited to motors, starters, disconnect switches and adjustable frequency drives furnished either as a separate or integral part of packaged mechanical equipment as specified.

Specific electrical requirements (i.e., horsepower and electrical characteristics, etc.) for mechanical equipment are specified within the individual equipment specification sections.

REFERENCES

NEMA Standards MG 1: Motors and Generators.
NEMA Standards ICS 2: Industrial Controls Devices, Controllers, and Assemblies.
NEMA Standard 250: Enclosures for Electrical Equipment.
NEMA Standard KS 1: Enclosed Switches.
Comply with National Electrical Code (NFPA 70).

SUBMITTALS

Product Data: Submit manufacturer's technical product data and installation instructions for each material described in this section as is applicable. These submittals and shop drawings shall be in no less detail than the product, material and installation descriptions provided herein and on the drawings. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

QUALITY ASSURANCE

Electrical components and materials shall be UL labeled.

MOTOR STARTERSMotor Starter Characteristics:

Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations, plenums and exterior locations shall be NEMA 3R with conduit hubs, or units in hazardous locations which shall have NEC proper class and division.

Type and size of starter shall be as recommend by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.

Manual switches shall have: Pilot lights and extra positions for multi-speed motors.

Overload protection: melting alloy type thermal overload relays.

Magnetic Starters:

Maintained contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated.

Trip-free thermal overload relays, each phase.

Interlocks, switches and similar devices as required for coordination with control requirements of Division - 23 Controls sections.

Built-in 120 volts control circuit transformer, fused from line side, where service exceeds 240 volts.

Externally operated manual reset.

Under-voltage release or protection.

DISCONNECTS SWITCHES

Fusible Switches: Fused, each phase; general duty; horsepower rated; non-feasible quick-make, quick-break mechanism; dead front line side shield; solderless lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the "Open" position; arc quenchers; capacity and characteristics as indicated.

Non-fusible Switches: For equipment 2 horsepower and smaller, shall be horsepower rated; toggle switch type; quantity of poles and voltage rating is indicated. For equipment larger than 2 horsepower, switches shall be the same as fusible type.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

GENERAL

Division 23 contractor shall provide all starters, contactors, and disconnects required to operate mechanical equipment provided by this Division 23 contractor unless specifically stated otherwise on the plans or in these specifications, including Division 26 plans and specifications.

WIRING FOR MECHANICAL EQUIPMENT

All power wiring for mechanical equipment shall be provided by Division 26 as required, unless stated otherwise in Division 23.

Wiring that is required as a part of Division 23 shall conform to the requirements for wiring methods and materials as stated in Division 26.

Provide detailed composite wiring diagrams for all control systems and equipment which may be required by Division 23. Verify electrical characteristics of equipment before ordering and finalize with Division 26. Reference electrical drawings for electrical characteristics of equipment specified herein and on the plans.

Division 23 shall be responsible for the correct functioning of all the control systems and equipment supplied by Division 23.

END OF SECTION 230513

SECTION 230529 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

SUMMARY

This Section includes hangers and supports for mechanical systems piping and equipment.

SUBMITTALS

General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

Product data for each type of hanger and support.

Submit pipe hanger and support schedule showing manufacturer's Figure No., size, location, and features for each required pipe hanger and support.

Shop drawings for each type of hanger and support, indicating dimensions, weights, required clearances, and methods of component assembly.

QUALITY ASSURANCE

NFPA Compliance: Comply with NFPA 13 for hangers and supports used as components of fire protection systems.

Listing and Labeling: Provide hangers and supports that are listed and labeled as defined in NFPA 70, Article 100.

UL and FM Compliance: Hangers, supports, and components include listing and labeling by UL and FM where used for fire protection piping systems.

Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

Licensed Operators: Use operators that are licensed by powder-operated tool manufacturers to operate their tools and fasteners.

PART 2 - PRODUCTS

MANUFACTURED UNITS

Hangers, Supports, and Components: Factory-fabricated according to MSS SP-58.

Components include galvanized coatings where installed for piping and equipment that will not have a field-applied finish.

Pipe attachments include nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.

Thermal-Hanger Shield Inserts: 100-psi (690kPa) average compressive strength, waterproofed calcium silicate, encased with sheet metal shield. Insert and shield cover entire circumference of pipe and are of length indicated by manufacturer for pipe size and thickness of insulation.

Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.

Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.

MISCELLANEOUS MATERIALS

Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex-head, track bolts and nuts.

Washers: ASTM F 844, steel, plain, flat washers.

Grout: ASTM C 1107, Grade B, non-shrink, nonmetallic.

Characteristics include post-hardening, volume-adjusting, dry, hydraulic cement-type grout that is non-staining, non-corrosive, non-gaseous and is recommended for both interior and exterior applications.

Design Mix: 5000-psi (34.5MPa), 28-day compressive strength.

Water: Potable.

Packaging: Premixed and factory-packaged.

PART 3 - EXECUTION

HANGER AND SUPPORT APPLICATIONS

Specific hanger requirements are specified in the Section specifying the equipment and systems.

Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping specification Sections.

HANGER AND SUPPORT INSTALLATION

General: Comply with MSS SP-69 and SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible.

Install the following pipe attachments:

Adjustable steel clevis hangers for individual horizontal runs less than 20' in length.

Adjustable roller hangers and spring hangers for individual horizontal runs 20' or longer.

Pipe roller complete – MSS Type 44 for multiple horizontal runs, 20' or longer, supported on a trapeze.

Spring hangers to support vertical runs.

Install hangers for horizontal piping with the following maximum spacing and minimum rod sizes:

<u>Nom. Pipe Size - In.</u>	<u>Steel Pipe Max. Span - Ft.</u>	<u>Copper Tube Max. Span - Ft.</u>	<u>Min. Rod Dia. - In.</u>
Up to ¾	7	5	3/8
1	7	6	3/8
1-1/4	7	7	3/8
1-1/2	9	8	3/8
2	10	8	3/8
2-1/2	11	9	1/2
3	12	10	1/2
3-1/2	13	11	1/2
4	14		5/8
5	15		5/8
6	15		3/4
8	15		7/8
10	15		7/8
12	15		7/8
14	15		1
16	15		1
18	15		1-1/4
20	15		1-1/4
24	15		1-1/2
30	15		1-1/2

Support vertical steel pipe and copper tube at each floor.

Support plastic pipe and tubing in accordance with manufacturer's recommendations.

Install Cast-Iron Pipe with piping supports located at end of each length of pipe in horizontal lines, at each bend, and vertical supports at maximum intervals of 14'. Locate supports near couplings, not in center of pipe.

Install supports with maximum spacing complying with MSS SP-69.

Where pipes of various sizes are supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert to forms. Install reinforcing bars through openings at top of inserts.

Install concrete inserts in new construction prior to placing concrete.

Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Do not use in lightweight concrete slabs or in concrete slabs less than 4" (100 mm) thick.

Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install according to fastener manufacturer's written instructions. Do not use in lightweight concrete slabs or in concrete slabs less than 4" (100 mm) thick.

Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

Heavy-Duty Steel Trapezes: Field-fabricate from ASTM A 36 steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

Support fire protection systems piping independent of other piping.

Install hangers and supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so that maximum pipe deflections allowed by ASME B31.9 "Building Services Piping" is not exceeded.

Insulated Piping: Comply with the following installation requirements.

Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

Saddles: Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.

Shields: Install MSS Type 40, protective shields on cold piping with vapor barrier. Shields span an arc of 180 degrees (3.1 rad) and have dimensions in inches (mm) not less than the following:

<u>NPS (Inches)</u>	<u>LENGTH (Inches)</u>	<u>THICKNESS (Inches)</u>
¼ to 3-1/2	12	0.048
4	12	0.060
5 and 6	18	0.060
8 to 14	24	0.075
16 to 24	24	0.105

Pipes 8" and Larger: Include wood inserts.

Insert Material: Length at least as long as the protective shield.

Thermal-Hanger Shields: Install with insulation of same thickness as piping.

EQUIPMENT SUPPORTS

Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor. Refer to Drawing Details (and Architectural Drawing/Spec's) for roof supports.

Grouting: Place grout under supports for equipment and make a smooth bearing surface.

METAL FABRICATION

Cut, drill, and fit miscellaneous metal fabrications for pipe and equipment supports.

Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

Field Welding: Comply with AWS D1.1 procedures for manual shielded metal-arc welding, appearance and quality of welds, methods used in correcting welding work, and the following:

Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

Obtain fusion without undercut or overlap.

Remove welding flux immediately.

Finish welds at exposed connections so that no roughness shows after finishing, and so that contours of welded surfaces match adjacent contours.

ADJUSTING

Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

PAINTING

Touching Up: Clean field welds and abraded areas of shop paint and paint exposed areas immediately after erection of hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces. Also, refer to Section 15050 for painting requirements.

Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

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

FIELD QUALITY CONTROL

Licensed Engineer's Report: Prepare hanger and support installation report. Include seal and signature of Registered Engineer, licensed in jurisdiction where Project is located, certifying compliance with specifications.

END OF SECTION 230529

SECTION 230593 – TESTING, ADJUSTING, AND BALANCING

PART 1 – GENERAL

This Section specifies the requirements and procedures total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications and recording and reporting the results. Test and Balance Contractor must be AABC or NEBB certified.

The Contractor shall procure the services of an independent balancing and testing agency which specializes in the balancing and testing of heating, ventilating, and air conditioning systems. The agency will balance, adjust, and test all heating, ventilating, and air conditioning systems within the building. The contractor shall provide test and balance to place the system in operation. The contractor shall participate in the Test and Balance, make any changes necessary, and pay for any retesting that may be required to meet specification and drawing requirements. This initial test and balance shall be performed in accordance with this specification and a written report shall be provided. The project will not be accepted as substantially complete until this report has been made.

The T&B Sub-Contractor shall coordinate with the BAS Sub-Contractor as required to set all design parameters.

Test, adjust, and balance the following mechanical systems:

- Supply, return, outside and exhaust air systems, all pressure/flow ranges; including variable volume systems. Test and balance all air devices and traverse duct at each air handler, and exhaust fan (record static and CFM).

- Electric Heaters, T&B and record static pressure, pressure drop, flow, entering and leaving temperatures.

- Test & Balance Exhaust Fans.

- Test & Balance AHUs (including Split Systems & Packaged DX):

- Cooling coils
 - Measure and record entering and leaving dry bulb and wet bulb temperatures.
- Heating coils/Heat exchangers
 - Measure and record entering and leaving temperatures; and

- Verify temperature control system operation in both heating and cooling modes.

In retrofit projects, record preliminary flow and pressure data to confirm proper operation of existing equipment prior to any demolition work and to confirm new operating conditions can be achieved. Submit preliminary report to Engineer.

The installing mechanical contractor shall make any necessary sheave/pulley and belt changes to obtain final air flows.

The test and balance contractor shall provide preliminary testing as necessary to assist the mechanical contractor.

The Test and Balance Contractor shall coordinate with the Control Contractor as well as the Mechanical Contractor.

Test systems for proper sound and vibration levels. Record sound and vibration levels in final report.

SUBMITTALS

Agency Data: Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

Engineer and Technicians Data:

Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

Forms shall be those standard forms prepared by the AABC or NEBB.

Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be handwritten, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.

Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.

Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:

- General Information and Summary
- Air Systems
- Temperature Control Systems

Report Contents: Provide the following minimum information, forms, and data:

General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses and contact names and telephone numbers. Also include a certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance Engineer.

Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.

The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC and NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

QUALITY ASSURANCE

Test and Balance Engineer's Qualifications: A Professional Engineer (either on the installer's staff or an independent consultant), registered in the State in which the services are to be performed, and having at least 3-years of successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for this project.

Agency Qualifications: The independent testing, adjusting, and balancing agency certified by National Environmental Balancing Bureau (NEBB) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified by NEBB as a Test and Balance Engineer.

Codes and Standards:

NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

AABC: "National Standards for Total System Balance."

ASHRAE: ASHRAE Handbook, 1984 Systems Volume, Chapter 37, Testing, Adjusting, and Balancing.

Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

PROJECT CONDITIONS

Systems Operation: Systems shall be fully operational prior to beginning procedures.

SEQUENCING AND SCHEDULING

Test, adjust, and balance the air systems before hydronic, steam, and refrigerant systems.

Test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 5°F wet bulb temperature of maximum summer design condition, and within 10°F dry bulb temperature of minimum winter design condition. Take final temperature readings during seasonal operation.

PART 2 – PRODUCTS – (NOT APPLICABLE)

PART 3 – EXECUTION

PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

Before operating the system, perform these steps:

Obtain design drawings and specifications and become thoroughly acquainted with the design intent.

Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.

Compare design to installed equipment and field installations.

Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.

Check filters for cleanliness.

Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.

Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.

Determine best locations in main and branch ductwork for most accurate duct traverses.

Place outlet dampers in the full open position.

Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting of deficiencies.

Lubricate all motors and bearings

Check fan belt tension

Check fan rotation

MEASUREMENTS

Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

Provide instruments meeting the specifications of the referenced standards.

Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

Apply instrument as recommended by the manufacturer.

Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until two (2) consecutive identical values are obtained.

Take all reading with the eye at the level of the indicated value to prevent parallax.

Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

Take measurements in the system where best suited to the task.

PERFORMING TESTING, ADJUSTING, AND BALANCING

Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

Test and document a minimum of 8 measured points for the variable flow pumping systems to verify system pumping performance.

Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

Patch insulation, ductwork, and housings, using materials identical to those removed.

Seal ducts and piping, and test for and repair leaks.

Seal insulation to re-establish integrity of the vapor barrier.

Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

TESTING FOR SOUND AND VIBRATION

Test and adjust mechanical systems for sound and vibration in accordance with the detailed instructions of the referenced standards.

RECORD AND REPORT DATA

Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

Record the total CFM measured at all of the outlets and compare to the total air flow measured at the unit.

END OF SECTION 230593

SECTION 230700 – MECHANICAL INSULATION

PART 1 – GENERAL

DESCRIPTION OF WORK

Extent of mechanical insulation required by this section is indicated on drawings and schedules, and by requirements of this section.

QUALITY ASSURANCE

Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

SUBMITTALS

Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation and its intended use. Submit schedule showing manufacturer's product number, R-value, thickness, and furnished accessories for each mechanical system requiring insulation.

Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

DELIVERY, STORAGE, AND HANDLING

Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

STANDARDS

2023 Florida Building Code, 8th Edition
Fiberglass Piping Insulation: ASTM C 547
Cellular Glass Insulation: ASTM C 552
Flexible Unicellular Insulation: ASTM C 534
Jackets for Insulation: ASTM C 921
Rigid Fiberglass Insulation ASTM C 612
Flexible Fiberglass Insulation: ASTM C 553

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS

Manufacturer: Subject to compliance with requirements, provide products of one of the following:

Armstrong World Industries, Inc.
Babcock & Wilcox; Insulating Products Div.
CertainTeed Corp.
Kingspan Corp.
Knauf Fiber Glass GmbH.
Manville Products Corp.
Owens-Corning Fiberglas Corp.
Pittsburgh Corning Corp.
Rubatex Corp.
Cell-U-Foam Corp.

MISCELLANEOUS INSULATION ACCESSORIES AND COMPOUNDS

General: Provide band wires, tape, anchors, corner angles, cement, adhesives, coatings, sealants, protective finishes, mastics, metal covers, wire netting, etc. as recommended by insulation manufacturer for application indicated.

Paper laminated jackets shall be permanently fire and smoke resistant. Chemicals used for treating paper in laminated jacket shall not be water soluble and shall be unaffected by water and humidity.

PIPING SYSTEM INSULATION

Fiberglass Pipe Insulation: Owens Corning ASJ/SSL-11 pipe insulation. Fittings to be fiberglass insulation inserts and PVC fitting covers. PVC fittings shall be Manville "Zeston 200" or Proto "Low-smoke."

Inorganic glass fibers, bonded with a thermosetting resin. Jacket shall be all-purpose, factory-applied, laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lap. ASTM C 612, Class 2, semi-rigid foil scrim kraft jacketed board.

Thermal Conductivity shall be 0.24 (BTU-in/hr - ft² - Deg F) average maximum, at 75 deg F mean temperature. Density, 6 pcf average. Adhesive produced under the UL classification and follow-up service.

Non-flammable, solvent-based, minus 20 to 180 deg F.

Vapor barrier sealant shall be flexible-elastomer-based, vapor-barrier sealant designed to seal fiberglass joints, water vapor permeance, 0.02 per maximum, minus 50 to 250 deg F, of a color gray.

Cellular Glass Insulation: Pittsburgh Corning "Foamglass" or Cell-U-Foam Corp. "Ultra-Cuf" insulation for above grade pipe insulation and below grade pipe insulation with conductivity of 0.40 BTU/SF/F at 75 deg. F and a permeability of 0.00 perms.

See Section in Division 23 for underground pre-insulated pipe.

Finish underground insulation (unless pre-insulated or pour in place insulation) with either Polyguard #60 Insulrap or Servi-Wrap P-500, in accordance with Pittsburgh Corning Bulletin FI-166 "Foamglass Insulation Systems for Underground Direct Burial Applications" and Manufacturer's Product Data Sheets, FI-122, "Pittwrap", FI-179, "Pittwrap SS Jacketing" and FI-155, "Pittwrap SS Primer".

Finish for machine rooms and piping subject to heavy traffic and chilled or hot water piping exposed to weather shall include Pittcote 404, Foster 30-70, or 30-80 reinforced with white glass fabric of not less than 7.8 ounces per yard. Then apply a second coat of Pittcote 404, Foster 30-70 or 30-80 and

brush lightly with a wet brush to a smooth finish. Elbows, valves, and fittings shall be finished with Pittcote 404, Foster 30-70 or 30-80 reinforced with white glass fabric.

Finish above ground insulation with white Kraft or vinyl-foil laminated fire-rated all-service jacket, all joints and laps sealed with fire-rated adhesive. Finish elbows, valves, fittings, etc., with Pittcote 404 reinforced with white glass fabric.

Flexible Elastomeric Insulation: Armstrong "AP Armaflex" pipe insulation and Armstrong "Armaflex II" sheet and roll insulation.

General: Provide insulation of thickness and type indicated on the following schedule (NOTE: Provide finish and jacketing as indicated above; provide additional field applied jacketing as indicated below.) (NOTE: comply with schedules noted below or FBC 2023 8th Ed., whichever is greater):

PIPE INSULATION SCHEDULE

INTERIOR DOMESTIC COLD WATER, HOT WATER & RECIRCULATED HOT WATER PIPING

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 1-1/4	Armaflex AP 25/50	1	NO	(A)(SS)
1-1/2 TO 4	Armaflex AP 25/50	1-1/2	NO	(A)(SS)
5 TO 10	Armaflex AP 25/50	1-1/2	NO	(A)(SS)

EXTERIOR DOMESTIC COLD WATER, HOT WATER & RECIRCULATED HOT WATER PIPING

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 1-1/4	Armaflex AP 25/50	1-1/2"	NO	(A)(SS)
1-1/2 TO 4	Armaflex AP 25/50	2"	NO	(A)(SS)

INTERIOR REFRIGERANT PIPING AND CHILLED WATER PIPING (35 TO 100 DEG) EXPOSED & CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 1-1/4	CELLULAR GLASS	1	YES	(A)(SS)
	Armaflex AP 25/50	3/4	YES	(A)(SS)
1-1/2 TO 4	CELLULAR GLASS	1-1/2	YES	(A)(SS)
5 TO 10	CELLULAR GLASS	1-1/2	YES	(A)(SS)

EXTERIOR REFRIGERANT PIPING & CHILLED WATER PIPING (35 TO 100 DEG) EXPOSED, CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 1-1/4	CELLULAR GLASS	2	YES	(A)(SS)
1/2 TO 1-1/4	Armaflex AP 25/50	1"	YES	(A)(SS)
1-1/2 TO 4	CELLULAR GLASS	2-1/2	YES	(A)(SS)
5 TO 10	CELLULAR GLASS	2-1/2	YES	(A)(SS)

INTERIOR HYDRONIC (100 TO 250 DEG F)**EXPOSED AND CONCEALED**

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 4	GLASS FIBER	1-1/2	NO	(A)(SS)
	CELLULAR GLASS	1-1/2	NO	(A)(SS)
5 TO 10	GLASS FIBER	2	NO	(A)(SS)
	CELLULAR GLASS	2-1/2	NO	(A)(SS)
12 TO 36	GLASS FIBER	2-1/2	NO	(A)(SS)
	CELLULAR GLASS	3	NO	(A)(SS)

EXTERIOR HYDRONIC (100 TO 250 DEG F)**EXPOSED AND CONCEALED**

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 4	CELLULAR GLASS	2-1/2	NO	(A)(SS)
5 TO 10	CELLULAR GLASS	3	NO	(A)(SS)
12 TO 36	CELLULAR GLASS	3	NO	(A)(SS)

NOTE: INSTALL OVER FREEZE PROTECTION HEAT TRACING.

DUCT SYSTEMS INSULATION SCHEDULE**INTERIOR CONCEALED HVAC SUPPLY, OUTSIDE AIR, EXHAUST AIR
AND RETURN DUCTS AND PLENUMS**

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
GLASS FIBER	WRAP	2 (1.5# Density)	YES	NONE

**INTERIOR EXPOSED & MECH ROOM HVAC SUPPLY, OUTSIDE AIR, EXHAUST AIR
AND RETURN DUCTS AND PLENUMS**

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
GLASS FIBER	BOARD-RECT.	2 (3# Density)	YES	(A) (SS)

EXTERIOR HVAC SUPPLY, RETURN, OUTSIDE & EXHAUST AIR DUCTS, AND PLENUMS*

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
CELLULAR GLASS	BOARD-RECT.	3	YES	(A) (SS)

*NOTE: INSTALL INSULATION & JACKET FOR WATER RUN-OFF (NO PUDDLING ON DUCT).

P = Paper A = Aluminum PVC = White PVC Jacket K = Kraft SS = Stainless Steel

CONDENSATE DRAINS

Insulate condensate drain piping above concealed spaced and in all mechanical rooms with 3/4" thick "AP" Armaflex (25/50 compliance) or approved equal. Insulate all condensate lines located in

return air plenums (in their entirety) with 1" fiberglass pipe insulation with all-service jacket. exterior condensate drains shall be covered with Aluminum Jacket and sealed watertight.

HANDICAPPED FIXTURES

Insulate hot water and cold water valves, supplies, and drains at handicapped lavatories with 1/2" thick "AP" Armaflex insulation, secured with Armstrong 520 adhesive. Insulate drains at handicapped lavatories with insulation jackets of similar composition to Armaflex with a vinyl cover.

PLUMBING VENTS, FLOOR DRAINS & HUB DRAINS

Insulate the body, trap, and all horizontal piping from floor drains, hub drains, and floor sinks receiving cold condensate water with 1" thick fiberglass pipe insulation.

Insulate the first 10 feet of piping from plumbing vents receiving cold condensate water with 1" thick fiberglass pipe insulation.

STORM WATER PIPING

Insulate roof drain bodies and horizontal rainwater leaders of stormwater piping.

FLEXIBLE CONNECTIONS

Provide 1" thick Armaflex insulation at all flexible connectors. Armaflex shall extend adequately beyond the foamglass or other rigid pipe insulation and secured by stainless steel bands.

COLD AND HOT HYDRONIC EQUIPMENT, PUMPS, VALVES, ETC.

Insulate with no less than 2" thick "foamglass," "Ultra-Cuf" insulation. Secure with stainless steel wire or bands. Finish with Pittcote 404, Foster 30-70 or 30-80 reinforced with white glass fabric. Then apply a second coat of Pittcote 404, Foster 30-70 or 30-80 and brush lightly with a wet brush to a smooth finish. On components requiring periodic inspecting (pumps, suction diffusers, etc.), provide removable insulation which will not damage the adjacent insulation.

Insulate pot feeders and connecting piping; install aluminum jacket.

Insulate air separators; install aluminum jacket.

DUCTWORK

Insulate all galvanized steel supply, return and outside air ductwork. Exhaust ducts shall not be insulated, except internally lined with insulation 10 feet of ductwork attached to and including the discharge plenums at exhaust louvers for noise considerations. Insulate exterior exhaust duct. Insulate outside air ducts.

Duct wrap shall be specifically designed for wrapping heating and air conditioning ductwork and include 2" overlap facing tab to provide for continuous vapor seal. Duct wrap shall be 2" thick, 1.5 lb. density, foil-scrim-Kraft laminated vapor barrier facing, minimum installed R-value equal to 6.0, and a maximum flame spread/smoke development rating of 25/50 per ASTM E84.

Insulate HVAC plenums and unit housings not pre-insulated at factory or lined with 2" thick, 3.0 lb density (minimum) board insulation with foil-scrim-Kraft vapor barrier.

AIR DEVICES

Insulate all exposed metal surfaces on back and neck of ceiling diffusers with 1" thick fiberglass with vapor barrier.

ACCESSORIES AND ATTACHMENTS

Glass Cloth (for fiberglass and calcium silicate insulation only): Woven glass fiber fabrics, plain weave, pre-sized a minimum of 8 ounces per square yard.

Cloth Standard: MIL-C-20079H, Type I.

Bands: 3/4-inch wide, in one of the following materials compatible with jacket:

Stainless Steel: type 304, 0.020 inch thick.

Galvanized Steel: 0.005 inch thick.

Aluminum: 0.007 inch thick.

Brass: 0.01 inch thick.

Nickel-Copper Alloy: 0.005 inch thick.

Wire: 14-gage nickel copper alloy, 16-gage, soft-annealed stainless steel, or 16-gage, soft-annealed galvanized steel.

Corner Angles: 28-gage, 1" x 1" aluminum, adhered to 2" x 2" Kraft paper.

Anchor Pins: Capable of supporting 20 pounds each. Provide anchor pins and speed washers of sizes and diameters as recommended by the manufacturer for insulation type and thickness.

PART 3 - EXECUTION

INSPECTION

Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

GENERAL

Insulation shall be applied on clean, dry surfaces.

All insulation shall be continuous through floor, wall and ceiling openings (including sleeves).

Insulation on all cold surfaces where vapor barrier jackets are used must be applied with a continuous, unbroken vapor seal; hangers, supports, anchors, etc., that are secured directly to cold surfaces, must be adequately insulated and vapor sealed to prevent condensation.

PIPE INSULATION INSTALLATION, GENERAL

Tightly butt longitudinal seams and end joints; bond with sealant or adhesive on closed cell insulation.

Stagger joints on double layers of insulation.

Apply insulation continuously over fittings, valves, and specialties, except as otherwise indicated. Apply insulation with a minimum number of joints.

Exterior Wall Penetrations: For penetrations of exterior walls, extend metal jacket for exterior insulation through penetration to a point 2" from interior surface of wall inside the building. Seal ends of metal jacket with vapor barrier coating. Secure metal jacket ends with metal band. At point where insulation metal jacket contacts mechanical sleeve seal, insert cellular glass preformed pipe insulation to allow sleeve seal tightening against metal jacket. Tighten and seal sleeve to jacket to form a watertight seal.

Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions. Apply an aluminum jacket with factory applied moisture barrier over insulation. Extend 2" from both surfaces of wall or partition. Secure aluminum jacket with metal bands at both ends. Seal ends of jacket with vapor barrier coating. Seal around penetration with joint sealer.

Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with fire-stopping or fire-resistant joint sealer.

Flanges, Fitting, and Valves - Interior Exposed and Concealed: Coat pipe insulation ends with vapor barrier coating. Apply premolded, precut, or field-fabricated segments of insulation around flanges, unions, valves, and fittings. Make joints tight; bond with adhesive.

Use same material and thickness as adjacent pipe insulation.

Overlap nesting insulation by 2" or 1 pipe diameter, whichever is greater.

Insulate elbows and tees with premolded insulation or insulation material segments. Use at least three (3) segments for each elbow.

Cover insulation except for metal jacketed insulation, with two (2) layers of lagging adhesive to a minimum thickness of 1/16". Install glass cloth between layers. Overlap adjacent insulation by 2" in both directions from joint with glass cloth and lagging adhesive.

Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments. Install shields, as specified in Division 23, Section – "Hangers and Supports."

Shields: Cover hanger shields with jacket material matching adjacent pipe insulation.

Apply insulation continuously through sleeves and manholes, except as specified above for exterior wall penetrations.

CELLULAR GLASS PIPE INSULATION INSTALLATION

Cellular Glass Insulation: Butter pipes and joints of foamglass insulation with Pittseal 444, Foster 95-60 or 95-44, or Childers CP-70. Apply insulation to pipe and fittings with all joints tightly fitted. Secure with aluminum bands (not greater than 12" on center) so that each length of insulation shall be secured with two bands (minimum). Insulation shall be applied with all joints fitted to eliminate voids. Voids shall be eliminated by refitting or replacing insulation. Do not fill voids with joint sealer.

Mastic finish application: Prior to application of the finish, the insulation shall be inspected for voids, cracked segments and open joints between segments. Cracked or broken segments, and open joints shall be refitted. Voids shall be filled with pieces of cellular glass insulation.

Cut the PC Fabric 79 or 4224 MAST-A-FAB to fit around the pipe or fitting allowing for 3" to 4" overlap. Using a glove or trowel, apply a tack coat of PITTCOAT 404, Foster 30-70 or 30-80 coating to a section of the insulation. The tack coat should be applied at a rate of 3-4 gal/100 sf.

Embed the PC Fabric 79 or 4224 MAST-A-FAB in the tack coat using a trowel, squeegee or glove to push the fabric in. Work the fabric into the coating until the appearance is uniform and there are no wrinkles or pinholes.

As an alternate method, the PC Fabric 79 or 4224 MAST-A-FAB may be applied to the insulation first and the tack coat of PITTCOTE 404 coating troweled or gloved through the fabric.

Apply another section of mastic overlapping the previous section by 3" and embed PC Fabric 79 or 4224 MAST-A-FAB as described in the above step. Each successive fabric section should overlap the previous one 3".

Continue working following the procedure above, until the entire line has received the PITTCOTE 404, Foster 30-70 or 30-80 coating tack coat and PC Fabric 79. Care should be taken to ensure the mastic is pinhole free.

Allow the first coat to dry a minimum of 24 hours (a minimum of 48 hours when relative humidity is higher than 80%) prior to application of the second coat.

With a glove or trowel, apply a second coat of PITTCOTE 404, Foster 30-70 or 30-80 coating at a rate of 2-3 gal/100 sf. Here again, it is important that the mastic be applied pinhole free.

INSTALLATION OF DUCTWORK INSULATION

General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purposes.

Insulation shall be continuous throughout the duct length and shall comply with NFPA Bulletin 90A requirements for flame spread and smoke developments. Insulation shall be applied to the duct with a solid surface of fire-retardant adhesive equal to Insul-Coustic 215 Sure-Stik.

Insulation applied to the top surface of horizontal duct shall overlap the side pieces to provide maximum support. In addition, insulation shall be secured with pins and clips not to exceed 12" on center. All exposed edges of board insulation shall receive brush coat of coating equal to Insul-Coustic 110.

Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

Maintain integrity of vapor-barrier on ductwork insulation and protect it to prevent puncture and other damage.

Extend ductwork insulation without interruption through walls, floors, and similar ductwork penetrations, except where otherwise indicated.

Install Blanket Wrap Insulation as Follows: Install uniform and smooth. Secure to ducts having long sides or diameters as follows:

Smaller Than 24": Bonding adhesive applied in 6-inch-wide transverse strips on 12" centers.

24" and Larger: Anchor pins spaced 12" apart each way. Apply bonding adhesive to prevent sagging of the insulation.

Overlap joints 3".

Seal joints, breaks, and punctures with glass fabric and mastic. **(Tape is not allowed.)**

Install rigid board insulation as follows:

Adhesive and Band Attachment: Secure board insulation tight and smooth with at least 50 percent coverage of adhesive. Install bands spaced 12" apart. Protect insulation under bands and at exterior corners with metal corner angles. Fill joints, seams, and chipped edges with vapor barrier compound.

Speed Washers Attachment: Secure insulation tight and smooth with speed washers and welded pins. Space anchor pins 18" apart each way and 3" from insulation joints. Apply vapor barrier coating compound to insulation in contact, open joints, breaks, punctures, and voids in insulation.

Cellular Glass Insulation: Install in same manner as cellular glass pipe insulation, including aluminum jacketing.

INSTALLATION OF EQUIPMENT INSULATION

General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.

Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.

Do not apply insulation to equipment while hot or cold.

Apply insulation using staggered joint method for both single- and double-layer construction, where feasible. Apply each layer of insulation separately.

Coat insulated surfaces with layer of insulating cement, troweled in workmanlike manner, leaving smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.

Provide removable insulation sections to cover parts of equipment that must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames, and accessories.

Equipment Exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, and aluminum jacketing on all exterior equipment.

INSULATION JACKETS

Exterior Exposed Insulation: Install continuous aluminum jackets and seal all joints and seams with waterproof sealant.

Install aluminum (ASTM B209, 3003 alloy, H-14 temper 0.02" thick) jacket with 2" overlap at longitudinal and butt joints. Overlap longitudinal joints to shed water. Seal butt joints and longitudinal joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with aluminum or stainless-steel draw bands 12" on center and at butt joints. Jacket shall be continuous. Include screws or bands on elbows and other fittings as necessary.

Foil and Paper Jackets (FP): Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2" laps at longitudinal joints and 3" wide butt strips at end joints.

Seal openings, punctures, and breaks in vapor barrier jackets and exposed insulation with vapor barrier compound.

FINISHES

Flexible Elastomeric Cellular Insulation: After adhesive has fully cured, apply two coats of protective coating to exposed insulation.

INSULATION REPAIR

Repair damaged sections of mechanical insulation damaged during this construction period.

PROTECTION AND REPLACEMENT

Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

PAINT

Refer to Division 23 and Drawings for painting requirements.

END OF SECTION 230700

SECTION 232300 – REFRIGERANT PIPING

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions 00 and 1 Specification Sections, apply to this Section.

Requirements of Division 23 Sections apply to this section (including, but not limited to):

- Mechanical Requirements
- Common Work Results for HVAC
- Hangers and Supports

SUMMARY

This Section includes refrigerant piping used for air conditioning applications. This Section includes:

- Pipes, tubing, fittings, and specialties
- Special duty valves
- Refrigerants

Related Sections: The following sections contain requirements that relate to this section:

Division 23, Section "Mechanical Insulation" for pipe insulation.

Products installed but not furnished under this Section include pre-charged tubing, refrigerant specialties, and refrigerant accessories furnished as an integral part of or separately with packaged air conditioning equipment.

SUBMITTALS

Product data for the following products:

- Each type valve specified.
- Each type refrigerant piping specialty specified.

Shop Drawings showing layout of refrigerant piping, specialties, and fittings including, but not necessarily limited to, pipe and tube sizes, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and proximate to equipment.

Brazer's Certificates signed by Contractor certifying that Brazers comply with requirements specified under "Quality Assurance" below.

Maintenance data for refrigerant valves and piping specialties, for inclusion in Operating and Maintenance Manual specified in Division 01 and Division 23 Section "Mechanical Requirements."

QUALITY ASSURANCE

Qualify brazing processes and brazing operators in accordance with ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications".

Regulatory Requirements: Comply with provisions of the following codes:

ANSI B31.5: ASME Code for Pressure Piping - Refrigerant Piping.

ANSI/ASHRAE Standard 15: Safety Code for Mechanical Refrigeration.

2023 Florida Building Code (8th Edition)

PART 2 - PRODUCTS

MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:

Refrigerant Valves and Specialties:

Alco Controls Div, Emerson Electric.
Danfoss Electronics, Inc.
EATON Corporation, Control Div.
Henry Valve Company.
Parker-Hannifin Corporation, Refrigeration and Air Conditioning Division.
Sporlan Valve Company.

PIPE AND TUBING MATERIALS

General: Refer to Part 3, Article "PIPE APPLICATION" for identification of systems where the below specified pipe and fitting materials are used.

Copper Tubing: ASTM B 280, Type ACR, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to shipping.

FITTINGS

Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.

JOINING MATERIALS

Brazing Filler Metals: AWS A5.8, Classification BAg-1 (Silver).

VALVES

General: Complete valve assembly shall be UL-listed and designed to conform to ARI 760.

REFRIGERANT PIPING SPECIALTIES

General: Complete refrigerant piping specialty assembly shall be UL-listed and designed to conform to ARI 760.

Moisture/Liquid Indicators: 500 psig maximum operation pressure, 200 deg. F maximum operating temperature; forged brass body, with replaceable polished optical viewing window, and solder end connections.

Flanged Unions: 400 psig maximum working pressure, 330 deg. F maximum operating temperature; two brass tailpiece adapters for solder end connections to copper tubing; flanges

for 7/8 inch through 1-5/8-inch unions shall be forged steel, and for 2-1/8 inch through 3-1/8 inch shall be ductile iron; four plated steel bolts, with silicon bronze nuts and fiber gasket. Flanges and bolts shall have factory-applied rust-resistant coating.

Flexible Connectors: 500 psig maximum operating pressure; seamless tin bronze or stainless-steel core, high tensile bronze braid covering, solder connections, and synthetic covering; dehydrated, pressure tested, minimum 7 inch in length.

REFRIGERANT

Refrigerant (required for split-system Unit), in accordance with ASHRAE Standard 34.

PART 3 - EXECUTION

EXAMINATION

Examine rough-in for refrigerant piping systems to verify actual locations of piping connections prior to installation.

Coordinate all Refrigerant piping work and Refrigerant piping accessories with the manufacturer for this specific application. Provide all piping, pipe sizes, pipe accessories as recommended by manufacturer for proper operation and equipment life of the HVAC Systems.

PIPE APPLICATIONS

Use Type ACR drawn copper tubing with wrought copper fittings and brazed joints above ground, within building. Use Type K, annealed temper copper tubing for 2 inch and smaller without joints, below ground and within slabs. Mechanical fittings (crimp or flair) are not permitted.

Install annealed temper tubing in pipe duct. Vent pipe duct to the outside.

PIPING INSTALLATIONS

General: Install refrigerant piping in accordance with ASHRAE Standard 15 - "The Safety Code for Mechanical Refrigeration."

Install piping in as short and direct arrangement as possible to minimize pressure drop.

Install piping for minimum number of joints using as few elbows and other fitting as possible.

Arrange piping to allow normal inspection and servicing of compressor and other equipment. Install valves and specialties in accessible locations to allow for servicing and inspection.

Provide adequate clearance between pipe and adjacent walls and hanger, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full thickness insulation.

Insulate suction lines. Liquid lines are not required to be insulated, except where they are installed adjacent and clamped to suction lines, where both liquid and suction lines shall be insulated as a unit.

Do not install insulation until system testing has been completed and all leaks have been eliminated.

Install branch tie-in lines to parallel compressors equal length, and pipe identically and symmetrically.

Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.

Slope refrigerant piping as follows:

Install horizontal hot gas discharge piping with 1/2" per 10 feet downward slope away from the compressor.

Install horizontal suction lines with 1/2 inch per 10 feet downward slope to the compressor, with no long traps or dead ends which may cause oil to separate from the suction gas and return to the compressor in damaging slugs.

Install traps and double risers where indicated, and where required to entrain oil in vertical runs.

Liquid lines may be installed level.

Use fittings for all changes in direction and all branch connections.

Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1 inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6" and larger shall be sheet metal.

Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division 15 for special sealers and materials.

Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.

Install strainers immediately ahead of each expansion valve, solenoid valve, hot gas bypass valve, compressor suction valve, and as required to protect refrigerant piping system components.

Install moisture/liquid indicators in liquid lines between filter/driers and thermostatic expansion valves and in liquid line to receiver. Install moisture/liquid indicators in lines larger than 2-1/8" OD, using a bypass line.

Install unions to allow removal of solenoid valves, pressure regulating valves, expansion valves, and at connections to compressors and evaporators.

Install flexible connectors at the inlet and discharge connection of compressors.

HANGERS AND SUPPORTS

General: Hanger, supports, and anchors are specified in Division 23 Section "HANGERS AND SUPPORTS." Conform to the table below for maximum spacing of supports:

Install the following pipe attachments:

Adjustable steel clevis hangers for individual horizontal runs less than 20' in length.

Roller hangers and spring hangers for individual horizontal runs 20' or longer.

Pipe rollers complete supports for multiple horizontal runs, 20' or longer supported by a trapeze.

Spring hangers to support vertical runs.

Install hangers with the following minimum rod sizes and maximum spacing:

<u>NON. PIPE SIZE</u>	<u>MAX. SPAN-FT</u>	<u>MIN. ROD SIZE - INCHES</u>
Up to 1-1/4"	5	3/8

Support vertical runs at each floor.

PIPE JOINT CONSTRUCTION

Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."

WARNING: Some filler metals contain compounds which produce highly toxic fumes when heated.

Avoid breathing fumes. Provide adequate ventilation.

CAUTION: When solenoid valves are being installed, remove the coil to prevent damage. When sight glasses are being installed, remove the glass. Remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties before brazing. Do not apply heat near the bulb of the expansion valve.

Fill the pipe and fittings during brazing, with an inert gas (i.e., nitrogen or carbon dioxide) to prevent formation of scale.

Heat joints using oxy-acetylene torch; heat to proper and uniform brazing temperature.

VALVE INSTALLATIONS

General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions.

Install globe valves on each side of strainers and driers, in liquid and suction lines at evaporators, and elsewhere as indicated.

Install pressure regulating and relieving valves as required by ASHRAE Standard 15.

EQUIPMENT CONNECTIONS

The Drawings indicate the general arrangement of piping, fittings, and specialties.

Install piping adjacent to machine to allow servicing and maintenance.

FIELD QUALITY CONTROL

Repair leaking joints using new materials, and retest for leaks.

ADJUSTING AND CLEANING

Verify actual evaporator applications and operating conditions and adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

Clean and inspect refrigerant piping systems in accordance with requirements of Division 23 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings".

Adjust controls and safeties. Replace damaged or malfunctioning controls and equipment with new materials and products.

COMMISSIONING

Charge system using the following procedure:

Install core in filter dryer after leak test but before evacuation.

Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance of refrigerant piping valves and refrigerant piping specialties.

Review data in Operating and Maintenance Manuals. Refer to Division 01 Section "Project Closeout

END OF SECTION 232300

SECTION 233100 – DUCTWORK

PART 1 – GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to this Section.

Requirements of Division 23 Sections apply to this section (including, but not limited to):

- Basic Mechanical Requirements
- Basic Mechanical Materials and Methods

SUMMARY

This Section includes rectangular and round metal ducts and plenums for heating, ventilating, and air conditioning systems in pressure classes from minus 2" to plus 10" water gage.

Related Sections: The following sections contain requirements that relate to this Section:

- Division 23 Section "Mechanical Insulation" for exterior duct and plenum insulation.
- Division 23 Section "Duct Accessories" for flexible duct materials, dampers, duct-mounted access panels and doors, and turning vanes.
- Division 23 Section "Air outlets and Inlets."
- Division 23 Section "Testing, Adjusting, and Balancing."
- Division 23 Section "Controls" for automatic volume control dampers and operators.

DEFINITIONS

Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this Section, the following definitions apply:

Seams: A seam is defined as joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the perimeter are deemed to be joints.

Joints: Joints include girth joints; branch and sub-branch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures.

SYSTEM PERFORMANCE REQUIREMENTS

The duct system design, as indicated, has been used to select and size air moving and distribution equipment and other components of the air system. Changes or alterations to the layout or configuration of the duct system must be specifically approved in writing. Accompany requests for layout modifications with calculations showing that the proposed layout will provide the original design results without increasing the system total pressure.

The duct system shall be tested for leakage in accordance with SMACNA HVAC Duct Leakage Test Manual – Latest Edition. Medium pressure duct (i.e. ductwork upstream of VAV boxes) shall meet Class 6 requirements (rectangular) or Class 3 (round).

Construct, Secure and Support Exterior Ductwork to Comply with FBC Wind Loads.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.

Product data including details of construction relative to materials, dimensions of individual components, profiles, and finishes for the following items:

Sealing Materials
Fire-Stopping Materials

Welding certificates including welding procedures specifications, welding procedures qualifications test records, and welders' qualifications test records complying with requirements specified in Division 23, Section "Basic Mechanical Requirements".

Record drawings including duct systems routing, fittings details, reinforcing, support, and installed accessories and devices, in accordance with Division 23, Section "Basic Mechanical Requirements" and Division 01.

Maintenance data for volume control devices, fire dampers, and smoke dampers, in accordance with Division 23 Section "Basic Mechanical Requirements" and Division 01.

QUALITY ASSURANCE

NFPA Compliance: Comply with the following NFPA Standards:

NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," except as indicated otherwise.

PART 2 – PRODUCTS

FLEXIBLE DUCTS

General: Comply with UL 181, Class 1.

Flexible Ducts – Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing glass fiber (minimum (R-6), 1" thick in conditioned areas, 1-1/2" thick in non-conditioned spaces) insulation around a continuous inner liner.

Reinforcement: Steel-wire helix encapsulated in the inner liner.

Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fiber glass tape, and nylon hanging cord.

Inner Liner: Polyethylene film.

Acoustical Medium Pressure Flexible Duct:

Provide where indicated on drawings Flexmaster (or approved equal) Type 8M UL181 Class 1 Air Duct.

The duct shall be constructed of a CPE fabric supported by helical wound galvanized steel. The internal working pressure rating shall be at least 10" w.g. positive and 4" w.g. negative with a bursting pressure of at least 2 ½ times the working pressure.

The duct shall be rated for a velocity of at least 4000 feet per minute.

The duct must be suitable for continuous operation at a temperature range of -20°F to +250°F.

Acoustical performance, when tested by an independent laboratory in accordance with the Air Diffusion Council's Flexible Air Duct Test Code FD 72-R1, Section 3.0, Sound Properties, shall be as follows:

The insertion loss (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be at least:

Octave Band	2	3	4	5	6	7
Hz	125	250	500	1000	2000	4000
6" Diameter	7	31	40	38	40	27
8" Diameter	13	29	36	35	38	22
12" Diameter	21	28	29	33	26	12

The radiated noise reduction (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be at least:

Octave Band	2	3	4	5	6	7
Hz	125	250	500	1000	2000	4000
6" Diameter	5	8	7	8	11	15
8" Diameter	10	7	7	8	10	13
12" Diameter	9	6	6	5	9	13

The self generated sound power levels (LW) dB re 10^{-12} watt of a 10 foot length of straight duct for an empty sheet metal duct when tested in accordance with ASTM E477, at a velocity of 1000 feet per minute, shall not exceed.

Octave Band	2	3	4	5	6	7
Hz	125	250	500	1000	2000	4000
6" Diameter	42	31	23	18	17	21
8" Diameter	41	34	27	19	18	21
12" Diameter	54	45	38	31	27	23

Factory insulate the flexible duct with fiberglass insulation. The R value shall be at least R=6.0 at a mean temperature of 75°F.

Cover the insulation with a fire-retardant metalized vapor barrier jacket reinforced with crosshatched scrim having a permeance of not greater than 0.05 perms when tested in accordance with ASTM E96, Procedure A.

Manufacturers Flexible Duct Connectors:

Clevaflex
Genflex type

Wiremold
Flexmaster

SHEET METAL MATERIALS

Sheet Metal, General: Provide sheet metal in thicknesses indicated, packaged, and marked as specified in ASTM A 700.

Galvanized Sheet Steel: Lock-forming quality, ASTM A 653, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.

Reinforcement Shapes and Plates: Unless otherwise indicated, provide galvanized steel reinforcing where installed on galvanized sheet metal ducts. For aluminum and stainless-steel ducts provide reinforcing of compatible materials.

Tie Rods: Galvanized steel, 1/4" minimum diameter for 36" length or less; 3/8" minimum diameter for lengths longer than 36".

SEALING MATERIALS

Joint and Seam Sealant: One-part, non-sag, solvent-release-curing, polymerized butyl sealant complying with FSTT-S-001657, Type I; formulated with a minimum of 75% solids; High Pressure Sealant.

Flanged Joint Mastics: One-part, acid-curing, silicone elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O; high pressure sealant.

FIRE-STOPPING

Fire-Resistant Sealant: Provide one-part elastomeric sealant formulated for use in a through-penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

Products: Subject to compliance with requirements, provide one of the following:

Dow Corning Fire Stop Sealant, Dow Corning Corp.
3M Fire Barrier Caulk CP-25; Electrical Products Div./3M.
RTV 7403; General Electric Co.
Fyre Putty; Standard Oil Engineered Materials Co.

HANGERS AND SUPPORTS

Building Attachments: Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for building materials. Do not use powder actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4" thick.

Hangers: Galvanized sheet steel, or round, steel, threaded rod.

Hangers Installed in Corrosive Atmospheres: Electro-galvanized, all-thread rod or hot-dipped-galvanized rods with threads painted after installation.

Straps and Rod Sizes: Conform to Table 4-1 in SMACNA HVAC Duct Construction Standards, 1985 Edition, for sheet steel width and gage and steel rod diameters.

Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

Trapeze and Riser Supports: Steel shapes conforming to ASTM A 36. Where galvanized steel ducts are installed, provide hot-dipped-galvanized steel shapes and plates.

RECTANGULAR DUCT FABRICATION

General: Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel, in accordance with SMACNA "HVAC Duct Construction Standards," Tables 1-3 through 1-19, including their associated details. Conform to the requirements in the referenced standard for metal thickness, reinforcing types and intervals, tie rod applications, and joint types and intervals.

Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.

Provide materials that are free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

Static Pressure Classifications: Except where otherwise indicated, construct duct systems to the following pressure classifications:

Supply Ducts Upstream of Boxes: 6" water gage, positive.

Supply Ducts Downstream of Boxes (& Constant Volume Systems): 2.5" water gage, positive.

Return Ducts: 2" water gage, negative pressure.

Exhaust Ducts: 2" water gage, positive and negative.

Outside Air Ducts: 2.5" water gage, positive and negative.

Cross-breaking or Cross Beading: Cross-break or bead duct sides that are 19" and larger and are 20 gage or less, with more than 10 sf. of unbraced panel area, as indicated in SMACNA "HVAC Duct Construction Standard."

RECTANGULAR DUCT FITTINGS

Fabricate elbows, transitions, offsets, branch connections, and other duct construction in accordance with SMACNA "HVAC Metal Duct Construction Standard," 1985 Edition, Figures 2-1 through 2-10.

ROUND DUCT FABRICATION

General: "Basic Round Diameter" as used in this article is the diameter of the size of round duct. Except where interrupted by fittings, provide round in lengths not less than 12'.

Round Ducts: Provide round supply and return ducts and fittings as indicated with spiral lock-seam construction, except for diameters greater than 72". Use longitudinal butt-welded seams. Comply with SMACNA "HVAC Duct Construction Standards," Table 3-2 for galvanized steel gages.

System Pressure Classifications: Refer to rectangular duct fabrication for minimum pressure applications.

ROUND FITTINGS FABRICATION

90-Degree Tees and Laterals and Conical Tees: Fabricate to conform to SMACNA "HVAC Duct Construction Standards," 1985 Edition, Figures 3-4 and 3-5 and with metal thicknesses specified for longitudinal seam straight duct.

Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from the body onto branch tap entrance.

Elbows: Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate the bend radius of die-formed, gored, and pleated elbows 1.5 times the elbow diameter. Unless elbow construction type is indicated, provide elbows meeting the following requirements:

Mitered Elbows: Fabricate mitered elbows with welded construction in gages specified below.

Mitered Elbows Radius and Number of Pieces: Unless otherwise indicated, construct elbow to comply with SMACNA "HVAC Duct Construction Standards," Table 3-1.

Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from 2" to 10":

3 to 14": 24 gage.

15 to 26": 22 gage.

27 to 50": 20 gage.

90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems, or exhaust systems for material handling classes A and B; and only where space restrictions do not permit the use of 1.5 bend radius elbows. Fabricate with a single-thickness turning vanes.

Round Elbows - 8" and Smaller: Die-formed elbows for 45° and 90° elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend angle configurations or ½" diameter (e.g. 3-1/2" and 4-1/2") elbows with gored construction.

Round Elbows - 9 Through 14": Gored or pleated elbows for 30, 45, 60, and 90 degrees, except where space restrictions require a mitered elbow. Fabricate nonstandard bend angle configurations or ½-inch-diameter (e.g. 9-1/2- and 10-1/2-inch) elbows with gored construction.

Round Elbows - Larger Than 14" Elbows: Gored elbows, except where space restrictions require a mitered elbow.

Die-Formed Elbows for Sizes Through 8" and All Pressures: 20 gage with 2-piece welded construction.

Round Gored Elbows Gages: Same as for non-elbow fittings specified above.

Pleated Elbows Sizes Through 14" and Pressures Through 10": 26 gage.

PART 3 – EXECUTION

DUCT INSTALLATION, GENERAL

Flexible duct runs shall be a maximum of 6' and shall be supported every 3' with minimum 1 ½" strap. Maximum permissible sag is ½" per foot.

Flexible duct connections shall include 3 wraps of approved tape and stainless-steel draw band. Insulation jacket shall be sealed with 3 wraps of approved UL 181B tape.

Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification indicated.

Seal ALL duct seams, joints, etc with generous coating of High-Pressure Duct Sealant (except double wall duct which shall be sealed with push joints or other means for "clean finished" look).

Install ducts with the fewest possible joints.

Use fabricated fittings for all changes in directions, changes in size and shape, and connections.

Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.

Locate ducts, except as otherwise indicated, vertically and horizontally, parallel, and perpendicular to building lines; avoid diagonal runs. Install duct systems in shortest route that does not obstruct usable space or block access for servicing building and its equipment.

Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

Provide clearance of 1" where furring is shown for enclosure or concealment of ducts, plus allowance for insulation thickness, if any.

Install insulated ducts with 1" clearance outside of insulation.

Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown.

Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

Non-Fire-Rated Partition Penetrations: Where ducts pass interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2".

HANGING AND SUPPORTING

Install rigid round, rectangular, and flat oval metal duct with support systems indicated in SMACNA "HVAC Duct Construction Standards," Tables 4-1 through 4-3 and Figures 4-1 through 4-8.

Support horizontal ducts within 2' of each elbow and within 4' of each branch intersection.

Support vertical ducts at a maximum interval of 16' and at each floor.

Upper attachments to structures shall have an allowable load not exceeding one fourth of the failure (proof test) load but are not limited to the specific methods indicated.

Install concrete insert prior to placing concrete.

Install powder actuated concrete fasteners after concrete is placed and completely cured.

Provide all supplemental steel as required to support new ductwork. Comply with SMACNA HVAC Duct Construction Standards and Manufacturer's recommendations.

All Exterior Ductwork shall be fabricated, supported, and secured to comply with FBC Wind Loads.

CONNECTIONS

Equipment Connections: Connect equipment with flexible connectors in accordance with Division 23 Section "Duct Accessories".

Branch Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figures 2-7 and 2-8.

Outlet and Inlet Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figures 2-16 through 2-18.

Terminal Units Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figure 2-19.

Double Wall Duct Connections: Shall comply with MFR's Requirements and SMACNA "HVAC Duct Construction Standards." Connections between single wall duct and double wall duct shall be done in such a way that no exposed insulation is in the airstream. Overlap insulation work as required to prevent duct sweating.

FIELD QUALITY CONTROL

The Contractor will contract with an independent testing agency to perform, record, and report leakage tests in the presence of the Engineer.

Remake leaking seams and joints as required and apply sealants to achieve specified maximum allowable leakage.

ADJUSTING AND CLEANING

Adjust volume control devices as required by the testing and balancing procedures to achieve required air flow. Refer to Division 23 Section "TESTING, ADJUSTING, AND BALANCING" for requirements and procedures for adjusting and balancing air systems.

Vacuum ducts systems prior to final acceptance to remove dust and debris.

END OF SECTION 233100

SECTION 233300 – DUCT ACCESSORIES

PART 1 – GENERAL

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to this Section.

SUMMARY

This Section includes the following:

- Flexible connections
- Manual volume control dampers
- Fire dampers
- Turning vanes
- Duct-mounted access doors and panels
- Accessories hardware
- Electric Duct Heating Coils

Related Sections: The following Sections contain requirements that relate to this Section:

Division 23 Section "Air Outlets and Inlets" for diffusers, registers, and grilles.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.

Product data including details for materials, dimensions of individual components, profiles, and finishes for the following items:

- Manual volume control dampers.
- Fire dampers.
- Duct-mounted access panels and doors.
- Electric Duct Heating Coils

Shop drawings from manufacturer detailing assemblies. Include dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection. Detail the following:

Special fittings and volume control damper installation (both manual and automatic) details.

Fire damper installations, including sleeves and duct-mounted access door and panel installations.

Product Certification: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static pressure loss, and dimensions and weights.

QUALITY ASSURANCE

NFPA Compliance: Comply with the following NFPA Standards:

- NFPA 80, "Standard for Fire Doors and Other Opening Protectives"
- NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

EXTRA MATERIALS

Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.

Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

FLEXIBLE CONNECTIONS:

General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering flexible connections which may be incorporated in the work include, but are not limited to, the following:

American/Elgen Co.; Energy Div.
Duro Dyne Corp.
Flexaust (The) Co.
Ventfabrics, Inc.

MANUAL VOLUME CONTROL DAMPERS

General: Provide factory-fabricated volume-control dampers, complete with required hardware and accessories. Stiffen damper blades to provide stability under operating conditions. Provide locking quadrant device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class. Provide end bearings or other seals for ducts with pressure classifications of 3 inches or higher. Extend axles full length of damper blades. Provide bearings at both ends of operating shaft, which must extend through insulation.

Standard Volume Control Dampers: Multiple-blade, opposed-blade design (20 gauge) as indicated, standard leakage rating, with linkage outside of air stream, and suitable for horizontal or vertical applications. Blades shall not exceed 6".

Steel Frames: Hat-shaped, galvanized-steel channels, minimum of 18 gage, and with mitered and welded corners. Provide flangeless frames where indicated for installation in ducts.

Roll-Formed Steel Blades: 20-gage galvanized steel.

Blade Axles: Galvanized steel.

Tie Bars and Brackets: Galvanized steel.

FIRE DAMPERS

General: Provide fire dampers for all fire rated partitions, walls, and floors as defined by the Architectural drawings and specifications. For renovation projects, contractors shall field verify existing conditions prior to submitting their bids. Fire dampers shall be UL labeled according to UL Standard 555 "Standard for Fire Dampers." Refer to Fire Damper Schedule at the end of this section.

Fire Rating: 1-1/2 hr. for 1 hr. and 2 hr. rated walls and 3 hr. for 3 hr. and 4 hr. rated walls as indicated by the fire rating of the wall to be penetrated. Refer to architectural drawings.

Frame: Type B; with frame and retracted blades outside of airstream fabricated with roll-formed, 21-gage, galvanized-steel; with mitered and interlocking corners.

Mounting Sleeve: Factory-installed or field-installed galvanized steel. Breakaway connections shall be utilized. Rigid connections require specific approval by the Engineer.

Minimum Thickness: 20 gauge for ducts 84" wide and smaller. Sleeve gauge shall in no case be less than the connecting ducts.

18 gauge for ducts 85" wide and larger.

Mounting Orientation: Vertical or horizontal as indicated.

Blades: Roll-formed, interlocking, 21-gage galvanized steel. In place of interlocking blades, provide full-length, 21-gage, galvanized-steel blade connectors.

Horizontal Dampers: Include a blade lock and stainless steel negator closure spring.

Fusible Link: Replaceable, 165 deg F.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering fire and smoke dampers which may be incorporated in the work include the following:

Air Balance, Inc.
American Warming and Ventilating, Inc.
Arrow Louver and Damper; Div. of Arrow United Industries Inc.
Louvers and Dampers, Inc.
Penn Ventilator Co.
Phillips-Aire.
Ruskin Mfg. Co.

TURNING VANES

Fabricate turning vanes according to SMACNA HVAC Duct Construction Standards, Figures 2-2 through 2-7.

Manufactured Turning Vanes: Fabricate of 1 1/2" wide, curved blades set at 3/4" in center, support with bars perpendicular to blades set at 2" on center and set into side strips suitable for mounting in ducts.

DUCT-MOUNTED ACCESS DOORS AND PANELS

General: Refer to the Access Door Materials Schedule at the end of this Section for frame and door thickness, number of hinges and locks, and location of locks. Provide construction and airtightness suitable for duct pressure class.

Frame: Galvanized sheet steel. Provide with bend-over tabs and foam gaskets.

Door: Double-wall, galvanized sheet metal construction with insulation fill and thickness, number of hinges and locks as indicated for duct pressure class. Provide vision panel where indicated. Provide 1" by 1" butt hinge or piano hinge and cam latches.

Seal around frame attachment to duct and door to frame with neoprene or foam rubber seals.

Insulation: 1" thick fiber glass or polystyrene foam board.

ACCESSORIES HARDWARE

Splitter Damper Accessories: Zinc-plated damper blade bracket, 1/4", zinc-plated operating rod, and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

Adhesives: High strength, quick setting, neoprene based, waterproof and resistant to gasoline and grease.

Electric Duct Heating Coils: Provide heating coils constructed of electric resistance elements in galvanized steel casing with control box and factory-wiring. Electric duct heater shall be UL listed and UL labeled. Electric Duct Heaters can be slip-in type.

Provide over-temperature safety protective devices for each heater, consisting of automatic reset thermal cutout placed in the control circuit and secondary replaceable thermal cutout. Heaters exceeding 48 amperes line current shall be divided into sections and separate fuse blocks per N.E.C. Entire assembly shall be factory wired to a single set of main power lugs.

Heater shall be arranged to prevent stratification when operating at less than full capacity.

Provide a factory wired built-in over-current protection with primary fusing, primary voltage rated for heater voltage. Heater controls shall be compatible with building control system modifications. See Drawings.

Provide pressure-type air flow switch (set at 0.07" WC adjustable), fan interlock relay, 80% in. - 20% chr. element wire derated to 25 watts per square inch. Heaters shall satisfy all requirements of the National Electrical Code and the Underwriter's Laboratories, Inc., and shall be UL listed for zero clearance.

Provide electric heat coil with SCR Controller with distributive zero-cross firing (to minimize interference to other loads). Coordinate with building control contractor and electrical contractor prior to bid and provide all components and accessories for a fully operational and controllable system.

All electrical components of units shall be internally wired and fused for a single point electrical power connection. Provide integral door interlocking disconnect switch and over-current device.

Electric Duct Heater manufacturers include, but are not limited to, Warren, Dell Heatrix, and Markel.

PART 3 - EXECUTION

EXAMINATION

Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of duct accessories. Do not proceed with installation until unsatisfactory conditions are corrected.

INSTALLATION

Install duct accessories according to manufacturer's installation instructions and applicable portions of details of construction as shown in SMACNA standards.

Provide test holes at fan inlet and outlet and elsewhere as indicated.

Install fire dampers according to the manufacturer's UL-approved printed instructions.

Provide access doors in ductwork and in hard ceilings (when necessary) for maintenance of fire and fire/smoke dampers.

Install fusible links in fire dampers. Demonstrate to Engineer access and replacement of fusible links; adjust duct size, access door size and placement, duct configuration, etc as required for ease of maintenance and access of fire dampers and linkages.

Label access doors according to Division 23 Section "Mechanical Identification" and NFPA 80.

Install electric duct heater in strict accordance with manufacturer's instructions and NEC, FBC, and UL requirements

ADJUSTING

Adjust duct accessories for proper settings.

Adjust fire and smoke dampers for proper action.

Final positioning of manual dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

ACCESS DOOR MATERIALS SCHEDULE

DUCT PRESSURE CLASS	DOOR SIZE INCHES	NUMBER OF HINGES	NUMBER OF LOCKS	METAL GAUGE		
				FRAME	DOOR	BACK
2 INCHES & LESS*	12X12	2	1-S	24	26	26
	16x20	2	2-S	22	24	26
	24X24	3	2-S	22	22	26
3 INCHES*	12X12	2	1-S	22	22	26
	16X20	2	1-S,1-T,1-B	20	20	26
	24X24	3	2-S,1-T,1-B	20	20	24
4 TO 10** INCHES	12X12	2	1-S,1-T,1-B	20	20	26
	16X20	3	2-S,1-T,1-B	20	18	24
	24X24	3	2-S,2-T,2-B	18	18	24

S: SIDE

T: TOP

B: BOTTOM

*NOTE: Ruskin M#ADH-24 or pre-approved equal.

**NOTE: Ruskin M#ADH-24HP or pre-approved equal.

END OF SECTION 233300

SECTION 233400 – FANS

PART 1 – GENERAL

RELATED DOCUMENTS

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

Requirements of the following Division 23 Sections apply to this section:

- Basic Mechanical Requirements
- Basic Materials and Methods

SUMMARY

This Section includes the following types of air-handling units:

- Inline Centrifugal Fans.
- Ceiling-mounted ventilators

Related Sections: The following sections contain requirements that relate to this section:

- Division 26 Section, "Circuit and Motor Disconnects" for disconnect switches.
- Division 26 Section, "Motor Controllers" for motor starters.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data for selected models, including specialties, accessories, and the following:

- Certified fan performance curves with system operating conditions indicated.
- Certified fan sound power ratings.
- Motor ratings and electrical characteristics plus motor and fan accessories.
- Materials gages and finishes, including color charts.
- Dampers, including housings, linkages, and operators.

Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.

Coordination drawings, in accordance with Division 23 Section "Basic Mechanical Requirements," for fan wall layouts, wall penetration requirements, and reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:

- Ceiling suspension members.
- Method of attaching hangers to building structure.
- Size and location of initial access modules for acoustical tile.
- Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer installed wiring and field installed wiring.

Product certificates, signed by manufacturers of Fans, certifying that their products comply with specified requirements.

Maintenance data for fans, for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 23, Section "Basic Mechanical Requirements".

QUALITY ASSURANCE

UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705 "Power Ventilators."

UL Compliance: Fans and components shall be UL listed and labeled.

Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

DELIVERY, STORAGE, AND HANDLING

Lift and support units with the manufacturer's designated lifting or supporting points.

Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.

Deliver fan units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

SEQUENCING AND SCHEDULING

Coordinate the installation of curbs, curb adapters, equipment & duct supports, and wall penetrations.

Coordinate the size and location of structural steel support members.

EXTRA MATERIALS

Furnish one additional complete set of belts for each belt-driven fan.

PART 2 - PRODUCTS

MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include but are not limited to, the following:

Inline Centrifugal Fans:

Cook (Loren) Co.
Greenheck Fan Corp.
Penn Ventilator Co.

Ceiling-Mounted Ventilators:

Cook (Loren) Co.
Greenheck Fan Corp.
Penn Barry Co.

SOURCE QUALITY CONTROL

Testing Requirements: The following factory tests are required:

Sound Power Level Ratings: Comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans in accordance with AMCA Standard 300 "Test Code for Sound Rating." Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.

Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA Standard 210/ASHRAE Standard 51 – Laboratory Methods of Testing Fans for Rating.

FANS, GENERAL

General: Provide fans that are factory fabricated and assembled, factory tested, and factory finished, with indicated capacities and characteristics.

Fans and Shafts: Statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.

Fan Shaft: Turned, ground, and polished 316 Stainless Steel designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fan's class.

Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.

Service Factor: 1.4.

Belts: Oil-resistant, non-sparking, and non-static.

Motors and Fan Wheel Pulleys: Adjustable pitch for use with motors through 15 HP; fixed pitch for use with motors larger than 15 HP. Select pulley so that pitch adjustment is at the middle of the adjustment range at fan design conditions.

Belt Guards: Provide steel belt guards for motors mounted on the outside of the fan cabinet.

Inverter Duty Motors required for fans with variable speed (frequency) drive.

Shaft Bearings: Provide type indicated, having a median life "Rating Life" (AFBMA L 50) of 200,000, calculated in accordance with AFBMA Standard 9 for ball bearings and AFBMA Standard 11 for roller bearings.

Factory Finish: The following finishes are required:

Sheet Metal Parts: Prime coating prior to final assembly.

Exterior Surfaces: Baked-enamel finish coat after assembly (shall pass 1,000-hour salt spray test).

INLINE CENTRIFUGAL FANS

General Description: Inline, belt-driven or direct drive, as indicated, centrifugal fans consisting of housing, wheel, fan shaft, bearings, drive assembly, motor and disconnect switch, mounting brackets, and accessories.

Housing: The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18 gauge galvanized steel with integral duct collars. Bolted access doors shall be provided on three sides, sealed with closed cell neoprene gasketing. Pivoting motor plate shall utilize threaded L-bolt design for positive belt tensioning. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation. Unit shall bear an engraved aluminum nameplate. Provide with inlet and outlet flanges, and support bracket adaptable to floor, or ceiling/attic mounting.

Direct-Drive Units: Motor encased in housing out of air stream, factory-wired to disconnect located on outside of fan housing.

Belt-Drive Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

Wheel: Aluminum, airfoil blades welded to aluminum hub, or backward inclined blades. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, *Balance Quality and Vibration Levels for Fans*.

Accessories: The following accessories are required as indicated and as scheduled:

Companion Flanges: For inlet and outlet duct connections.

Speed Control: Variable speed switches with on-off control and speed control for 100 to 50 percent of fan air delivery for direct drive units.

Back Draft Dampers: Manufacturer's Standard

Disconnect Switch: Non-fusible type with thermal overload protection, factory mounted and wired.

Auto-Belt Tensioner

CEILING-MOUNTED VENTILATORS

General Description: Centrifugal fan designed for installation in ceiling, wall, or concealed inline applications.

Housing: Galvanized steel lined with acoustical insulation.

Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

Grille: Aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

Remote Fan Speed Control: Solid state, capable of controlling fan speed from full speed to approximately half speed.

Accessories: Manufacturer's standard disconnect switch/plug and backdraft damper. Provide mounting brackets, wall cap, and transition fittings as required for fan installation.

Light Switch with 10-minute time delay.

PART 3 - EXECUTION

EXAMINATION

Examine areas and conditions with Installer present for compliance with requirements for installation tolerances, housekeeping pads, and other conditions affecting performance of fans.

Do not proceed until unsatisfactory conditions have been corrected.

INSTALLATION, GENERAL

Install fans level and plumb, in accordance with manufacturer's written instructions. Support units as described below, using the vibration isolation devices indicated.

Suspended Units: Suspend units from structural steel support frame using threaded steel rods and vibration isolation springs.

Arrange installation of units to provide access space around fans for service and maintenance; and, for access to service panels.

CONNECTIONS

Duct installations and connections are specified in other Division 23 sections. Make final duct connections with flexible connections.

Electrical Connections: The following requirements apply:

Electrical power wiring is specified in Division 26.

Temperature control wiring and interlock wiring are specified in "Controls" and Drawings.

Grounding: Connect unit components to ground in accordance with the National Electrical Code.

FIELD QUALITY CONTROL

Manufacturer's Field Inspection: Arrange and pay for a factory- authorized service representative to perform the following:

Inspect the field assembly of components and installation of fans including ductwork and electrical connections.

Prepare a written report on findings and recommended corrective actions.

ADJUSTING, CLEANING, AND PROTECTING

Adjust damper linkages for proper damper operation.

Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

COMMISSIONING

Final Checks before Start-Up: Perform the following operations and checks before start-up:

Remove shipping blocking and bracing.

Verify unit is secure on mountings and supporting devices and that connection for piping, ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.

Perform cleaning and adjusting specified in this Section.

Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.

Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.

Verify manual and automatic volume control and that fire and smoke dampers in connected ductwork systems are in the full-open position.

Disable automatic temperature control operators.

Starting Procedures for Fans:

Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.

Measure and record motor electrical values for voltage and amperage.

Shut unit down and reconnect automatic temperature control operators.

Refer to Division 23, Section "Testing, Adjusting, and Balancing" for procedures for air handling system testing, adjusting, and balancing.

DEMONSTRATION

Demonstration Services: Arrange and pay for a factory-authorized service representative to train Owner's maintenance personnel on the following:

Procedures and schedules related to start-up and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.

Familiarization with contents of Operating and Maintenance Manuals specified in Division 1, Section "Project Closeout" and Division 23, Section "Basic Mechanical Requirements."

Schedule training with at least seven (7) days' advance notice.

END OF SECTION 233400

SECTION 233700 – AIR OUTLETS AND INLETS

PART 1 – GENERAL

DESCRIPTION OF WORK

Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.

Types of air outlets and inlets required for project include the following:

- Ceiling air diffusers.
- Registers and grilles.
- Louvers

QUALITY ASSURANCE

Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

Codes and Standards:

ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets."

ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets."

ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual."

ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.

AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters."

AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.

NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems."

Florida Product Approval (or Miami-Dade NOA)

SUBMITTALS

Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:

- Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.

- Data sheet for each type of air outlet and inlet, and accessory furnished, indicating construction, finish, and mounting details.

Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature, and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.

Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components. Submit Florida Product Approval or Miami Dade NOA for Louvers.

Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 01.

PRODUCT DELIVERY, STORAGE AND HANDLING

Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

CEILING AIR DIFFUSERS

General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity, and type indicated; constructed of materials and components as indicated, and as required for complete installation.

Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule.

Manufacturer: Subject to compliance with requirements, provide diffusers of one of the following:

Anemostat Products Div.; Dynamics Corp. of America.
Carnes Co.; Div. of Wehr Corp.
Krueger Mfg. Co.
Metalaire
Price
Titus Products Div., Philips Industries, Inc.
Tuttle & Bailey; Div. of Interpace Corp.

GRILLES

General: Except as otherwise indicated, provide manufacturer's standard grilles where shown; of size, shape, capacity, and type indicated; constructed of materials and components as indicated, and as required for complete installation.

Performance: Provide grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

Types: Provide wall registers and grilles of type, capacity, and with accessories and finishes as listed on the schedule.

Manufacturer: Subject to compliance with requirements, provide registers and grilles of one of the following:

Anemostat Products Div, Dynamics Corp. of America.
Carnes Co.; Div. of Wehr Corp.
Krueger Manufacturing Company
Price
Metalaire
Titus Products Div.; Philips Industries, Inc.
Tuttle and Bailey

LOUVERS

General: Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation. Louvers must be Florida Product Approved or have Miami Dade NOA.

Performance: Provide louvers that have minimum free area, and maximum pressure drop for each type as listed in manufacturer's current data, complying with louver schedule.

Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrates which will contain each type of louver.

Materials: Construct of aluminum extrusions, ASTM B 221, Alloy 6063-T52. Weld units or use stainless steel fasteners.

Louver Screens: On inside face of exterior louvers, provide 5/8" x 0.040" expanded, flattened anodized aluminum bird screens mounted in removable extruded aluminum frames.

Finishes: Kynar 500 two-coat system comprised of an inhibitive primer and fluorocarbon polymeric finish coat. Custom color; coordinate color with the Architect.

Fluorocarbon Coating: Inhibitive thermo-cured primer, 0.2 mil minimum dry film thickness and thermo-cured fluorocarbon coating containing "Kynar 500" resin, 1.0 mil minimum dry film thickness.

Manufacturer: Subject to compliance with requirements, provide louvers of one of the following:

Airline Products Co.
Airolite Co.
American Warming & Ventilating, Inc.
Arrow United Industries, Inc.

Construction Specialties, Inc.
Dowco Corp.
Greenheck
Industrial Louvers, Inc.
Louvers & Dampers, Inc.
Penn Ventilator Co., Inc.
Ruskin Mfg. Co.
Safe-Air Inc.
Snyder (E.G.) Co., Inc.
Vent Products Co., Inc.

PART 3 - EXECUTION

INSPECTION

Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

INSTALLATION

General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that products serve intended functions.

Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

Locate and support ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules and support independently from ceiling.

Install Louvers in strict accordance with manufacturers' installation instructions and requirements and for Florida Product Approval or Miami-Dade NOA as applicable. Louvers of sufficient size requiring multiple sections to be fitted together shall be inspected by a manufacturers' representative and a field report shall be submitted accepting installation or noting deficiencies. Contractor shall promptly correct all deficiencies.

SPARE PARTS

Furnish to Owner, with receipt, three (3) operating keys for each type of air outlet and inlet that require them.

END OF SECTION 233700

SECTION 238126 – SPLIT SYSTEM HEAT PUMP UNITS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

Refer to other sections of these specifications for related work which is not work of this section.

DESCRIPTION OF WORK

Extent of split-system heat pump unit work required by this section is indicated on drawings and schedules, and by requirements of this section.

Electrical Work: Provide the following wiring as work of this section, in accordance with requirements of Division 26:

Provide control wiring between unit-mounted control panel and thermostats, remote control panels, and any other control device furnished as work of this section.

Provide factory-mounted and wired controls and electrical devices as specified in this section.

Refer to Division 26 sections for other electrical work including disconnects, wires/cables, raceways, and other required electrical devices; not work of this section.

QUALITY ASSURANCE

Manufacturer's Qualifications: Firms regularly engaged in manufacture of packaged heating and cooling units, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering indoor packaged units which may be incorporated in the work include the following:

Carrier Air Conditioning; Div. of Carrier Corp.
Daikin
Trane (The) Co.
York

Codes and Standards:

ARI Compliance: Provide capacity ratings for packaged heating and cooling units in accordance with ARI Standard 360 "Standard for Commercial and Industrial Unitary Air-Conditioning Equipment."

ASHRAE Compliance: Construct refrigerating system of packaged heating and cooling units in accordance with ASHRAE Standard 15 "Safety Code for Mechanical Refrigeration."

UL Compliance: Provide packaged heating and cooling units which are designed, manufactured, and tested in accordance with UL requirements.

SUBMITTALS:

Product Data: Submit manufacturer's technical product data, including rated capacities and efficiencies of selected model clearly indicated, dimensions, weights, furnished specialties and accessories; and installation and start-up instructions.

Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to split-system heat pump units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation of packaged heating and cooling units and controls. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

Maintenance Data: Submit maintenance data and parts list for each split-system heat pump unit, control, and accessory; including "trouble-shooting" maintenance guide. Include this data and product data in maintenance manual; in accordance with requirements of Division 01.

Refrigerant Detector: See Part II and Part III for requirements.

DELIVERY, STORAGE, AND HANDLING

Handle split-system units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged split-system units or components; replace with new.

Store split-system units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

Comply with manufacturer's rigging and installation instructions for unloading packaged heating and cooling units and moving units to final location for installation.

WARRANTY

All work and materials shall be warranted (parts and labor) for a period of one year from date of final acceptance by Owner.

SPECIAL PROJECT WARRANTY

Warranty on Motor/Compressor: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, motors/compressors with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.

Warranty Period: Minimum of 5 years from Date of Final Acceptance by Owner.

PART 2 - PRODUCTS

SPLIT SYSTEM HEAT PUMP UNITS

Provide air-cooled split system heat pump, as scheduled on the drawings, complete with air-cooled condensing unit, blower coil unit, electric heating coil and necessary controls. Each unit shall be factory assembled and wired. Condensing unit and blower coil shall be rated in accordance with ARI Standard 210-75 and 270-75 and bear UL or equal label.

Condensing unit shall have the following:

Hermetic or semi-hermetic compressor with vibration isolators and crankcase heater.

Condenser coil – copper tube and aluminum fins.

Condenser fans – TEFC direct drive with safety guards.

Housing - phosphatized (or galvanized) steel with baked enamel finish, removable covers for servicing and a hinged door on the control panel.

Provide units with brass refrigerant service valves, outdoor sight glass, and filter dryer. Provide reversing valve.

Controls – low voltage transformer, high and low pressure cutouts, compressor, thermal and current overloads, head pressure controls to 20°F ambient temperature. Compressor control circuit shall include adjustable 5-minute anti-recycle timer.

Condenser coil guard – heavy gauge aluminum (or PVC coated steel).

All condensing units to be bolted down and supported for 160 MPH wind load.

Factory starters and contactors.

Shaft shall have inherent corrosion resistance.

Two stage compressor

Blower fan coil unit shall have the following:

Type – Vertical type (as shown on drawings) with return air plenum and filter rack.

Casing – phosphatized (or galvanized) steel with baked enamel finish or galvanized steel, removable covers and insulated to prevent condensation on outside surface and fibers in airstream.

Drain pan – stainless steel or Lexan poly carbonate engineering resin material with threaded pipe connections.

Coils – copper tube and aluminum fins (test at 300 psig under water), direct expansion refrigerant, thermo static expansion valves.

Fan - forward curved or backward inclined centrifugal, Variable speed “electronically commutating motor” technology, permanently lubricated motors with inherent overload protection.

Filters – 1" throw-away, replaceable media in galvanized steel frame; minimum 30% efficiency (ASHRAE dust spot). Initial resistance shall not exceed 0.25" at 400 FPM face velocity.

Unit shall bear UL or equal label.

Unit support and vibration isolation.

Factory supplied/mounted starters and contactors, single point connection.

Float switch in primary drain. Hardwire to AHU blower motor.

External secondary drain pan.

Compressors: Provide serviceable semi-hermetic or hermetic compressors, with multi-step capacity control. Provide forced-feed lubrication with oil pump, and strainer or magnetic plugs. Provide gas-cooled hermetic motor with built-in overload protection.

ELECTRIC HEATERS

Provide electric strip heater with over-current over-temperature safety protective devices for each heater, consisting of automatic reset thermal cut-out placed in the control circuit and secondary replaceable thermal cut-out. Heaters exceeding 48 Amperes line current shall be divided into sections and separate fuse blocks per NEC. Entire assembly shall be factory wired to a single set of main power lugs. Provide a factory wired built-in control transformer with primary fusing, primary voltage rated for heater voltage and secondary voltage as required to operate control devices. Provide full line break mercury contactors, air flow switch, fan interlock relay, insulated terminal boxes, 80% NI, 20% CHR element wire derated to 35 watts per square inch. Where noted on the plans, heating elements shall be encased in steel tubular sheath. Heaters shall satisfy all requirements of the National Electrical Code and the Underwriters' Laboratories, inc., and shall be UL listed for zero clearance.

All electrical components of units shall be internally wired and fused for a single point electrical power connection.

CONTROLS

Provide programmable, 24 volt, minimum 2-stage cooling, 2-stage heating, variable speed AHU, wall thermostats to control split system heat pump units. Thermostats shall be deluxe horizontal type, auto change-over with "system cool off heat" settings, multi-set point type with "fan on auto" settings. Provide time-of-day, night setback, scheduling, off-hour override, dehumidification control, etc. Provide with LCD display. Install wall mounted thermostats 4'-0" above floor. Wire in accordance with the manufacturer's recommendations. **Note: Thermostat MUST have auxiliary outputs for controlling Outside Air Damper & Exhaust Fan; coordinate with manufacturer and provide Thermostat compatible with Unit similar to Venstar T4900 or approved equal.** Refer to Drawings for additional Information.

Where shown on drawings, install smoke detectors and all necessary related controls (i.e. contractors) to shut down the fans in the event of fire alarm or tripped smoke detector or fire stat. Smoke detectors shall be located in the supply air duct and return air duct at each air handler unit indicated as such.

Interlock all electric duct heaters with air handler fans to disable heater control circuits when air handlers are turned off.

Safety Controls: Provide factory-wired control panel containing at least the following:

- Contactors for each compressor and fan motor.
- High pressure, low pressure, and oil pressure cutouts.
- Non-recycling relay for automatic pump down
- Motor current and temperature overload protection

Electrical Requirements:

- Unit electrical power shall be a single point connection.
- Unit control voltage to the indoor-fan coil shall be 24v.
- All power and control wiring must be installed per NEC and all local building codes.
- Unit shall have high-and low-voltage terminal block connections.

Stop Valves: For systems containing more than 6.6 lbs of refrigerant shall have stop valves installed at:

1. The Suction inlet of each compressor, compressor unit or condensing unit;
2. The Discharge of each compressor, compressor unit or condensing unit; and
3. The Outlet of each liquid receiver.

Refrigerant Detector: Provide a factory mounted and wired refrigerant detector for Split-System Units. Refrigerant Detection systems shall include "self-test".

(Note: As far as the ASHRAE Standard 15 is concerned, the installed systems should be considered: Direct Systems, ducted, occupancy type as per application and high probability systems with A2L Refrigerants. Also, a machinery room is not required due to not exceeding refrigerant quantity limit.)

(Note: While the Basis of Design includes a Refrigerant Detector, it should be noted, unless the system exceeds a certain refrigerant quantity for the space it serves, a refrigerant detector may not be required by Code (although it is included in these design documents). For example, if the refrigerant quantities are less than prescribed by ASHRAE 15, a detector may not be required. With that said, the following calculation must also be utilized to make final determination on the Code requirement for a Refrigerant Detector:

"For commercial public assembly, and larger mercantile occupancies, when the refrigerant charge is of any independent circuit exceeds $0.212 \times LFL$ (lb.) where LFL is in pounds per 1000 cubic feet, unless the concentration of refrigerant in a complete discharge from any independent circuit will not exceed 50% of the RCL."

PART 3 - EXECUTION

INSPECTION:

General: Examine areas and conditions under which split-system units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

INSTALLATION OF SPLIT SYSTEM HEAT PUMP UNITS:

General: Install split-system units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

Support: Install units on 6" high reinforced concrete pad (4000 PSI), 4" larger on each side than equipment base. Cast anchor bolt inserts into pad. Secure all exterior units to meet or exceed FBC wind loads.

Support: Install vertical mounted AHUs in accordance with manufacturer's recommendations (provide all required support hardware). Support AHUs with spring isolators. Refer to drawings for additional information. Install vertical mounted AHUs on equipment base and neoprene pad isolators; refer to drawings. Prime and paint as indicated in specification and drawing.

CONTROLS

Contractor shall supply and install all control wiring, transformers, interlocks, sensors, end devices and accessories for equipment provided under this section, unless specifically noted otherwise, Control wiring includes all wiring for automatic system operation, external to the circuit, providing

power to each piece of mechanical equipment.

Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical installer.

Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

Air-Cooled Condenser Piping: Refer to Division 23 section "Refrigeration Piping Systems." Connect liquid and hot gas piping to unit as indicated.

Drain Piping: Connect unit drain and route as indicated in drawings. Provide trap at drain pan. Construct at least 1" deeper than fan pressure in inches of water. Refer to drawing detail for installation requirements.

IDENTIFICATION

Identify all mechanical equipment items with nameplates. See other spec sections.

REFRIGERANT SYSTEMS

Refrigerant Detector: On detection of refrigerant concentration exceeding 25% of Lower Flammability Limit (LFL), the system shall within 15 seconds of detection:

1. Turn on Supply Fan
2. Turn off Compressor and all other electrical devices, excluding control power transformers, control system and supply fan
3. Turn off electric heat
4. Outside Air Damper shall be "open" (Not Applicable to Mini-Split Units)
5. Exhaust fans shall be "on"
6. De-energize any flame producing equipment.

The System shall continue to operate in alarm mode for at least 5 minutes after the refrigerant detector has sensed a drop in refrigerant concentration below 25% LFL.

Refrigerant Detection System shall be witnessed and tested prior to Substantial Completion.

Refrigerant detector shall be located:

1. Ducted systems: Locate the detector within the equipment.

Refrigerant Piping shall be installed high as possible but a minimum of 7.25 feet above finished floor (unless the piping is installed against the ceiling and is allowed by the AHJ).

Labeling:

1. Label AHU & Condenser Section: I.D. Refrigerant Type and include label: "Warning – Risk of Fire. Flammable Refrigerant".
2. Label Refrigerant Piping: Every 20 feet, include the following label: "Warning – Risk of Fire. Flammable Refrigerant".

Installation Identification: Each Refrigerant System erected on the premises shall be provided with a legible permanent sign, securely attached and easily accessible indicating:

1. The Name and Address of the Installer
2. The Refrigerant number and amount of refrigerant
3. The Lubricant identity and amount, and
4. The field test pressure applied.

FIELD QUALITY CONTROL

General: Start-up split-system units, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

CLOSEOUT PROCEDURES

Training: Provide services of manufacturer's technical representative for 1-half day to instruct Owner's personnel in operation and maintenance of packaged heating and cooling units.

Schedule training with Owner, provide at least 7-day notice to Contractor and Engineer of training date.

SPARE PARTS:

General: Furnish to Owner, with receipt, the following spare parts for each split-system unit:

One set filter for each unit.

END OF SECTION 238126

SECTION 238126.01 - DUCTLESS SPLIT SYSTEMS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

Division 23, Basic Mechanical Materials and Methods sections apply to work of this section.

DESCRIPTION OF WORK

Extent of split-system cooling units work required by this section is indicated on drawings and schedules, and by requirements of this section.

Refer to other sections for automatic temperature controls not factory-installed and required for conjunction with packaged cooling units; not work of this section.

Electrical Work: Provide the following wiring as work of this section, in accordance with requirements of Division 26:

Provide control wiring between unit-mounted control panel and thermostats, remote control panels, and any other control device furnished as work of this section.

Provide factory-mounted and wired controls and electrical devices as specified in this section.

Refer to Division 26 sections for other electrical work including motor starters, disconnects, wires/cables, raceways, and other required electrical devices; not work of this section.

QUALITY ASSURANCE

Manufacturer's Qualifications: Firms regularly engaged in manufacture of packaged cooling units, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering units which may be incorporated in the work include but are not limited to the following:

Daikin
Mitsubishi Electric
Toshiba

Codes and Standards:

ARI Compliance: Provide capacity ratings for packaged cooling units in accordance with ARI Standard 360 "Standard for Commercial and Industrial Unitary Air-Conditioning Equipment".

ASHRAE Compliance: Construct refrigerating system of packaged cooling units in accordance with ASHRAE Standard 15 "Safety Code for Mechanical Refrigeration".

UL Compliance: Provide packaged cooling units which are designed, manufactured, and tested in accordance with UL requirements.

NEC Compliance: Provide units which are in compliance with NEC requirements.

SUBMITTALS

Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights, furnished specialties and accessories; and installation and start-up instructions.

Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to packaged cooling units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation of packaged cooling units and controls. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

Maintenance Data: Submit maintenance data and parts list for each packaged cooling unit, control, and accessory; including "trouble-shooting" maintenance guide. Include this data and product data in maintenance manual; in accordance with requirements of Divisions 00 & 01.

Refrigerant Detector: See Part II and Part III for requirements.

DELIVERY, STORAGE, AND HANDLING

Handle packaged cooling units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged packaged cooling units or components; replace with new.

Store packaged cooling units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

Comply with manufacturer's rigging and installation instructions for unloading packaged cooling units, and moving units to final location for installation.

WARRANTY:

Manufacturer's Standard Warranty, but not less than 1 year Parts & Labor Warranty (Beginning at Substantial Completion) and 4 Additional Years Compressor Parts only warranty.

PART 2 - PRODUCTS

High Wall Fan Coil Units: Indoor, direct-expansion, wall-mounted fan coil; unit shall be complete with cooling coil, fan, fan motor, piping connectors, electrical controls, micro-processor control system, and integral temperature sensing. Unit shall be furnished with integral wall-mounting bracket, mounting hardware.

Unit Cabinet: Cabinet discharge and inlet grilles shall be attractively styled, high-impact polystyrene. Cabinet shall be fully insulated for improved thermal and acoustic performance.

Fans: Fan shall be tangential direct-drive blower type with air intake at the upper front face of the unit and discharge at the bottom front. Automatic, motor-driven vertical air sweep shall be provided standard.

Air sweep operation shall be user selectable. Horizontal direction may be manually adjusted (using remote controller) and vertical air sweep may be manually set.

Coil: Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection for hose attachment to remove condensate. Condensate pan shall have internal trap and auxiliary drip pan under coil header.

Motors: Motors shall be open drip-proof, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be 3-speed.

Controls: Controls shall consist of a microprocessor-based control system which shall control space temperature, determine optimum fan speed, and run self diagnostics. The temperature control range shall be from 64 F to 84 F. The unit shall have the following functions as a minimum:

An automatic restart after power failure at the same operating conditions previous to failure.

A timer function to provide a minimum 24-hour timer cycle for system Auto Start/Stop.

Temperature-sensing controls shall sense return-air temperature. Indoor-air high discharge temperature shutdown shall be provided.

Indoor coil freeze protection.

Wireless infrared remote control to enter set points and operating conditions.

Auto Stop features shall have integral setback control.

Automatic airtightness control to provide on or off activation of airtightness louvers.

Dehumidification mode shall provide increased latent removal capability by modulating system operation and set point temperature.

Fan-only operation to provide room air circulation when no cooling is required.

Diagnostics shall provide continuous checks of unit operation and warn of possible malfunctions. Error messages shall be displayed at the unit and at the remote controller.

An indoor to outdoor thermistor connection cable shall be provided with the fan coil unit.

Fan speed control shall be user-selectable: high, medium, low, or microprocessor automatic operation during all operating modes.

A time delay shall prevent compressor restart in less than 3 minutes.

Automatic heating-to-cooling changeover to provide automatic heating and cooling operation. Control shall include deadband to prevent rapid mode cycling.

Demand defrost shall be provided and shall minimize defrost cycles by internally adjusting defrost timing based on frost accumulation.

Indoor coil high temperature protection shall be provided to detect excessive indoor discharge temperature when unit is in heat pump mode.

Filters: Unit shall have filter track with factory-supplied cleanable filters.

Electrical Requirements: Refer to Drawings and Equipment Schedule for electrical requirements. Power and control connections shall have terminal block connections.

Condensate Pump: The condensate pump shall remove condensate from the drain pan when gravity drainage cannot be used. Pump shall be designed for quiet operation. Pump shall consist of two parts: an internal reservoir/sensor assembly, and a remote sound-shielded pump assembly. The lift capability of the condensate pump shall be 10 ft. A level sensor on the condensate pan shall stop cooling operation if the level in the condensate pan is unacceptable.

Outdoor Unit: Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, full charge of R-454b refrigerant and special features required prior to field start-up.

Unit Cabinet: Unit cabinet shall be constructed of galvanized-steel, bonderized and coated with a baked-enamel finish.

Unit access panels shall be removable with minimal screws and shall provide full access to the compressor, fan, and control components.

Outdoor compartment shall be isolated and have an acoustic lining to assure quiet operation.

Fans: Outdoor fans shall be direct-drive propeller type, and shall discharge air horizontally. Fans shall blow air through the outdoor coil.

Outdoor fan motors shall be totally enclosed, single-phase motors with class B insulation and permanently lubricated sleeve bearings. Motor shall be protected by internal thermal overload protection.

Shaft shall have inherent corrosion resistance.

Fan blades shall be corrosion resistant and shall be statically and dynamically balanced.

Outdoor fan openings shall be equipped with PVC coated protection grille over fan and coil.

Compressor: Compressor shall be fully hermetic reciprocating or scroll type.

Compressor shall be equipped with oil system, operating oil charge, and motor. Internal overloads shall protect the compressor from over temperature and over current. Scroll compressors shall also have high discharge gas temperature protection if required.

Motor shall be NEMA rated class F, suitable for operation in a refrigerant atmosphere.

Reciprocating compressors shall be quipped with crankcase heaters to minimize liquid refrigerant accumulation in compressor during shutdown and to prevent refrigerant dilution of oil.

Compressor assembly shall be installed on rubber vibration isolators and shall have internal spring isolation.

Compressors shall be single phase as specified on the contract drawings.

Outdoor Coil: Coil shall be constructed of aluminum fins mechanically bonded to internally enhanced, seamless copper tubes which are cleaned, dehydrated, and sealed.

Refrigeration Components: Refrigerant circuit components shall include brass external liquid line service valve with service gage port connections, suction line service valve with service gage connection port, service gage port connections on compressor suction and discharge lines with Schrader-type fittings with brass caps, accumulator, bi-flow filter drier, pressure relief, reversing valve, and heating mode metering device.

Controls and Safeties: Operating controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include the following:

Controls:

Time delay restart to prevent compressor reverse rotation on single-phase scroll compressors.

Automatic restart on power failure.

Safety lockout if any outdoor unit safety is open.

A time delay control sequence is also provided standard through the fan coil board, thermostat, or controller.

High-pressure and liquid line low-pressure switches.

Automatic outdoor-fan motor protection.

Start capacitor and relay (single-phase units without scroll compressors).

Safeties:

System diagnostics.

Compressor motor current and temperature overload protection.

High pressure relief.

Outdoor fan failure protection.

Electrical Requirements:

Unit electrical power shall be a single point connection.

Unit control voltage to the indoor-fan coil shall be 24v.

All power and control wiring must be installed per NEC and all local building codes.

Unit shall have high-and low-voltage terminal block connections.

Stop Valves: For systems containing more than 6.6 lbs of refrigerant shall have stop valves installed at:

1. The Suction inlet of each compressor, compressor unit or condensing unit;
2. The Discharge of each compressor, compressor unit or condensing unit; and
3. The Outlet of each liquid receiver.

Refrigerant Detector: Provide a refrigerant detector equal to Danfoss DST G-Series A2L Refrigerant Detector with UL 60335-2-40 & UL 60335-2-89 Approvals & Certification – Note: coordinate with control subcontractor for integration requirements with mini-split controls prior to purchasing refrigerant detector. Refrigerant Detection systems shall include “self-test”.

(Note: As far as the ASHRAE Standard 15 is concerned, the installed systems should be considered: Direct Systems, non-ducted (mini-split systems), occupancy type as per application and high probability systems with A2L Refrigerants. Also, a machinery room is not required due to not exceeding refrigerant quantity limit.)

(Note: While the Basis of Design includes a Refrigerant Detector, it should be noted, unless the system exceeds a certain refrigerant quantity for the space it serves, a refrigerant detector may not be required by Code (although it is included in these design documents). For example, if the refrigerant quantities are less than prescribed by ASHRAE 15, a detector may not be required. With that said, the following calculation must also be utilized to make final determination on the Code requirement for a Refrigerant Detector:

“For commercial public assembly, and larger mercantile occupancies, when the refrigerant charge is of any independent circuit exceeds $0.212 \times LFL$ (lb.) where LFL is in pounds per 1000 cubic feet, unless the concentration of refrigerant in a complete discharge from any independent circuit will not exceed 50% of the RCL.”)

PART 3 - EXECUTION

INSPECTION

General: Examine areas and conditions under which cooling units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

INSTALLATION OF DUCTLESS SPLIT SYSTEM UNITS

General: Install cooling units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

Support: Install units on 6" high concrete pad, 8" larger on each side than equipment base. Cast anchor bolt inserts into pad.

Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical installer.

Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

Air-Cooled Condenser Piping: Refer to Division 23 section "Refrigeration Piping Systems". Connect liquid and hot gas piping to unit as indicated.

Drain Piping: Connect unit drain to nearest indirect waste connection. Provide trap at drain pan; construct at least 1" deeper than fan pressure in inches of water.

REFRIGERANT SYSTEMS

Refrigerant Detector: On detection of refrigerant concentration exceeding 25% of Lower Flammability Limit (LFL), the system shall within 15 seconds of detection:

1. Turn on Supply Fan
2. Turn off Compressor and all other electrical devices, excluding control power transformers, control system and supply fan
3. Turn off electric heat
4. Outside Air Damper shall be "open" (Not Applicable to Mini-Split Units)
5. Exhaust fans shall be "on"
6. De-energize any flame producing equipment.

The System shall continue to operate in alarm mode for at least 5 minutes after the refrigerant detector has sensed a drop in refrigerant concentration below 25% LFL.

Refrigerant Detection System shall be witnessed and tested prior to Substantial Completion.

Refrigerant detector shall be located:

1. Non-Ducted Systems: Locate the detector within the equipment or a location within 12" of the floor and within a horizontal distance of not more than 3.3 feet with a direct line of site of the unit.

Refrigerant Piping shall be installed high as possible but a minimum of 7.25 feet above finished floor (unless the piping is installed against the ceiling and is allowed by the AHJ).

Labeling:

1. Label AHU & Condenser Section: I.D. Refrigerant Type and include label: "Warning – Risk of Fire. Flammable Refrigerant".
2. Label Refrigerant Piping: Every 20 feet, include the following label: "Warning – Risk of Fire. Flammable Refrigerant".

Installation Identification: Each Refrigerant System erected on the premises shall be provided with a legible permanent sign, securely attached and easily accessible indicating:

1. The Name and Address of the Installer
2. The Refrigerant number and amount of refrigerant
3. The Lubricant identity and amount, and
4. The field test pressure applied.

FIELD QUALITY CONTROL

General: Start-up cooling units, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

CLOSEOUT PROCEDURES

Training: Provide services of manufacturer's technical representative for 1-half day to instruct Owner's personnel in operation and maintenance of cooling units.

Schedule training with Owner, provide at least 7-day notice to Contractor and Engineer of training date.

SPARE PARTS

General: Furnish to Owner, with receipt, the following spare parts for each cooling unit:

One set of filters for each unit.

END OF SECTION 238126.01

SECTION 260510 – BASIC ELECTRICAL REQUIREMENTS

PART 1 – GENERAL

SUMMARY

This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

- Submittals.
- Record documents.
- Maintenance manuals.
- Rough-ins.
- Electrical installations.
- Cutting and patching.

Related Sections: The following sections contain requirements that relate to this section:

Division 23 Section "ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT," for factory-installed motors, controllers, accessories, and connections.

Division 26 Section "BASIC ELECTRICAL MATERIALS AND METHODS," for materials and methods common to the remainder of Division 26, plus general related specifications including:

Access to electrical installations.

For Codes and Standards, see Electrical Drawing.

SUBMITTALS

General: Follow the procedures specified in Division 1 Section "SUBMITTALS."

MAINTENANCE MANUALS

Prepare maintenance manuals with following information:

Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

Servicing instructions and lubrication charts and schedules.

DELIVERY, STORAGE, AND HANDLING

Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

ROUGH-IN:

Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

ELECTRICAL INSTALLATIONS

General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:

Coordinate electrical systems, equipment, and materials installation with other building components.

Verify all dimensions by field measurements.

Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.

Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.

Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "ACCESS DOORS" and Division 26 Section "BASIC ELECTRICAL MATERIALS AND METHODS."

Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

Codes: Install all electrical work in accordance with the latest regulations of National Electrical Code, NFPA, and all other applicable regulations and local code enforcement official requirements.

CUTTING AND PATCHING

General: Perform cutting and patching as described below:

Perform cutting, fitting, and patching of electrical equipment and materials required to:

Uncover Work to provide for installation of ill-timed Work.

Remove and replace defective Work.

Remove and replace Work not conforming to requirements of the Contract Documents.

Remove samples of installed Work as specified for testing.

Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.

Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION 260510

SECTION 260511 – BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 – GENERAL

SUMMARY

This Section includes limited scope general construction materials and methods for application with electrical installations as follows:

Miscellaneous metals for support of electrical materials and equipment.

Wood grounds, nailers, blocking, fasteners, and anchorage for support of electrical materials and equipment.

Joint sealers for sealing around electrical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.

Access panels and doors in walls, ceilings, and floors for access to electrical materials and equipment.

DEFINITIONS

The following definitions apply to excavation operations:

Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract:

Product data for the following products:

Access panels and doors
Joint sealers

Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for electrical materials and equipment.

Coordination drawings for access panel and door locations in accordance with Division 26 Section "Basic Electrical Requirements."

Samples of joint sealer, consisting of strips of actual products showing full range of colors available for each product.

Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this Section.

Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of electrical service, and details for dust and noise control.

QUALITY ASSURANCE

Installer Qualifications: Engage an experienced Installer for the installation and application joint sealers, access panels, and doors.

Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel."

Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.

Provide UL Label on each fire-rated access door.

DELIVERY, STORAGE, AND HANDLING

Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

PROJECT CONDITIONS

Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

PART 2 – PRODUCTS

MISCELLANEOUS METALS

Steel plates, shapes, bars, and bar grating: ASTM A 36.

Cold-Formed Steel Tubing: ASTM A 500.

Hot-Rolled Steel Tubing: ASTM A 501.

Steel Pipe: ASTM A 53, Schedule 40, welded.

Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, recommended for interior and exterior applications.

Fasteners: Zinc-coated, type, grade, and class as required.

MISCELLANEOUS LUMBER

Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPB rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.

Construction Panels: Plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 15/32 inches.

JOINT SEALERS

General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.

Colors: As selected by the Architect from manufacturer's standard colors.

Elastomeric Joint Sealers: Provide the following types:

One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with nonporous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes.

Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

One-Part, Mildew-Resistant, Silicone Sealant:

Dow Corning 786, Dow Corning Corp.
SCS 1702 Sanitary, General Electric Co.
863 #345 White, Pecora Corp.
Rhodorsil 6B White, Rhone-Poulenc, Inc.
Proglaze White, Tremco Corp.
OmniPlus, Sonneborn Building Products Div.

Acrylic-Emulsion Sealants: One-part, nonsag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.

Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

Chem-Calk 600, Bostik Construction Products Div.
AC-20, Pecora Corp.
Sonolac, Sonneborn Building Products Div.
Tremco Acrylic Latex 834, Tremco, Inc.

Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

Dow Corning Fire Stop Foam, Dow Corning Corp.
Pensil 851, General Electric Co.

PART 3 – EXECUTION

PREPARATION FOR JOINT SEALERS

Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.

Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

ERECTION OF METAL SUPPORTS AND ANCHORAGE

Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

Field Welding: Comply with AWS "Structural Welding Code."

ERECTION OF WOOD SUPPORTS AND ANCHORAGE

Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

Select fastener sizes that will not 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 members.

Attach to substrates as required to support applied loads.

APPLICATION OF JOINT SEALERS

General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.

Comply with recommendations of ASTM C 790 for use of acrylic-emulsion joint sealants.

Tooling: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

END OF SECTION 260511

SECTION 260519 – WIRES AND CABLES

PART 1 – GENERAL

RELATED DOCUMENTS

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

Requirements of the following Division 26 Sections apply to this section, “Basic Electrical Requirements”.

SUMMARY

This Section includes wires, cables, and connectors for power, lighting, and related systems rated 600 volts and less.

SUBMITTALS

Product Data for electrical wires, cables and connectors.

QUALITY ASSURANCE

Regulatory Requirements: Comply with provisions of the following code:

NFPA 70 "National Electrical Code."

Conform to applicable codes and regulations regarding toxicity of combustion products of insulating materials.

UL Compliance: Provide components which are listed and labeled by UL under the following standards.

UL Std. 83	Thermoplastic-Insulated Wires and Cables.
UL Std. 486A	Wire Connectors and Soldering Lugs for Use with Copper Conductors.

NEMA/ICEA Compliance: Provide components which comply with the following standards:

WC-5 Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

IEEE Compliance: Provide components which comply with the following standard.

Std. 82 Test procedures for Impulse Voltage Tests on Insulated Conductors.

PART 2 – PRODUCTS

MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Wire and Cable:
American Insulated Wire Corp.
Brintec Corp.
Carol Cable Co. Inc.

Senator Wire and Cable Co.
Southwire Company.

Connectors for Wires and Cable Conductors:

AMP
3M Company
O-Z/Gedney Co.
Square D Company.
Thomas and Betts

WIRES AND CABLES

General: Provide wire and cable suitable for the temperature, conditions and location where installed.

Conductors: Provide solid conductors for power and lighting circuits no. 10 AWG and smaller. Provide stranded conductors for sizes no. 8 AWG and larger.

Conductor Material: copper for all wires and cables, 90°C rated,

Insulation: Provide THHN/THWN insulation for all conductors size no. 8 AWG and smaller. For all other sizes provide THHN/THWN or XHHW insulation as appropriate for the locations where installed.

Color Coding for phase identification in accordance with Table 1 in Part 3 below.

Jackets: Factory-applied nylon or PVC external jacketed wires and cables for pulls in raceways over 100-feet in length, for pulls in raceways with more than three equivalent 90 deg. bends, for pulls in conduits underground or under slabs on grade, and where indicated.

CONNECTORS FOR CONDUCTORS

Provide UL-listed factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.

PART 3 – EXECUTION

WIRING METHOD

Use the following wiring methods as indicated:

Wire: install all wire in raceway.

INSTALLATION OF WIRES AND CABLES

General: Install electrical cables, wires, and connectors in compliance with NEC.

Coordinate cable installation with other Work.

Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.

Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.

Conceal all cable in finished spaces.

Keep conductor splices to minimum.

Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced.

Use splice and tap connectors which are compatible with conductor material.

Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than no 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

FIELD QUALITY CONTROL

Prior to energizing, check installed wires and cables with megohm meter to determine insulation resistance levels to assure requirements are fulfilled.

Prior to energizing, test wires and cables for electrical continuity and for short-circuits.

Subsequent to wire and cable hook-ups, energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.

TABLE 1: Color Coding for Phase Identification:

Color code secondary feeder, and branch circuit conductors with factory applied color as follows:

<u>208y/120Volts</u>	<u>Phase</u>
Black	A
Red	B
Blue	C
White	Neutral
Green	Ground

END OF SECTION 260519

SECTION 260526 - GROUNDING

PART 1 – GENERAL

RELATED DOCUMENTS

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

Requirements of the following Division 26 Sections apply to this Section:

Basic Electrical Requirements

SUMMARY

This Section includes solid grounding of electrical systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data for ground rods, connectors and connection materials, and grounding fittings.

Report of field tests and observations.

QUALITY ASSURANCE

Listing and Labeling: Provide products specified in this Section that are listed and labeled. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.

Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

Field-Testing Organization Qualifications: To qualify for acceptance, the independent testing organization must demonstrate, based on evaluation of organization-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated.

Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code " (NEC).

UL Standard: Comply with UL 467, "Grounding and Bonding Equipment."

PART 2 – PRODUCTS

MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

Anixter Bros., Inc.
Bashlin Industries, Inc.
Buckingham Mfg. Co.
A.B. Chance Co.

Dossert Corp.
Engineered Products Co.
Erico Products, Inc.
Galvan Industries, Inc.
GB Electrical, Inc.
General Machine Products Co., Inc.
Hastings Fiber Glass Products, Inc.
Ideal Industries, Inc.
Kearney-National.
McGill Mfg.
O-Z/Gedney Co.
Raco, Inc.
Thomas & Betts Corp.
W.H. Salisbury & Co.
Utilco Co.

GROUNDING AND BONDING PRODUCTS

Products: Of types indicated and of sizes and ratings to comply with NEC. Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

Conductor Materials: Copper.

WIRE AND CABLE CONDUCTORS

General: Comply with Division 26 Section "Wires and Cables." Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

Equipment Grounding Conductor: Green insulated.

Grounding Electro Conductor: Stranded cable.

Bare Copper Conductors: Conform to the following:

Solid Conductors: ASTM B-3.

Assembly of Stranded Conductors: ASTM B-8.

Tinned Conductors: ASTM B-33.

MISCELLANEOUS CONDUCTORS

Ground Bus: Bare annealed copper bars of rectangular cross section.

Braided Bonding Jumpers: Copper tape, braided No. 30 gage bare copper wire, terminated with copper ferrules.

Bonding Strap Conductor/Connectors: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

CONNECTOR PRODUCTS

General: Listed and labeled as grounding connectors for the materials used.

Pressure Connectors: High-conductivity-plated units.

Bolted Clamps: Heavy-duty units listed for the application.

Exothermic Welded Connections: Provided in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.

GROUNDING ELECTRODES

Ground Rods: Copper-clad steel with high-strength steel core and electrolytic-grade copper outer sheath, molten welded to core.

Size: 3/4 inch by 10 feet.

PART 3 – EXECUTION

APPLICATION

Equipment Grounding Conductor Application: Comply with NEC Article 250 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated.

Install separate insulated equipment grounding conductors with circuit conductors for the following in addition to those locations where required by Code:

Single-phase motor or appliance circuits.

Three-phase motor or appliance branch circuits.

Lighting Circuits

Power Circuits

Nonmetallic Raceways: Install an insulated equipment ground conductor in nonmetallic raceways unless they are designated for telephone or data cables.

Air Duct Equipment Circuits: Install an insulated equipment grounding conductor to duct-mounted electrical devices operating at 120-V and above including air cleaners and heaters. Bond the conductor to each such unit and to the air duct.

Water Heater, Heat Tracing, Circuits: Install separate insulated equipment ground conductor to each electric water heater, heat tracing, and surface anti-frost heating cable. Bond this conductor to heater units, piping, and connected equipment and components.

Underground Conductors: Bare, stranded copper except as otherwise indicated.

Signal and Communications: For telephone, alarms, and communication systems, provide a #1/0 AWG minimum green insulated copper conductor in raceway from the grounding electrode system to each terminal cabinet or central equipment location.

INSTALLATION

General: Ground electrical systems and equipment in accordance with NEC requirements except where the Drawings or Specifications exceed NEC requirements.

Ground Rods: Locate a minimum of one-rod length from each other and at least the same distance from any other grounding electrode. Interconnect ground rods with bare conductors buried at least 24 inches below grade. Connect bare cable ground conductors to ground rods by means of exothermic welds except as otherwise indicated. Make these connections without damaging the

copper coating or exposing the steel. Use 3/4-inch by 10-ft. ground rods except as otherwise indicated. Drive rods until tops are 6 inches below finished floor or final grade except as otherwise indicated.

Metallic Water Service Pipe: Provide insulated copper ground conductors, sized as indicated, in conduit from the building main service equipment, or the ground bus, to main metallic water service entrances to the building. Connect ground conductors to the main metallic water service pipes by means of ground clamps. Where a dielectric main water fitting is installed, connect the ground conductor to the street side of the fitting. Do not install a grounding jumper around dielectric fittings. Bond the ground conductor conduit to the conductor at each end.

Braided-Type Bonding Jumpers: Install to connect ground clamps on water meter piping to bypass water meters electrically. Use elsewhere for flexible bonding and grounding connections.

Route grounding conductors along the shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.

Bond interior metal piping systems and metal air ducts to equipment ground conductors of pumps, fans, electric heaters, and air cleaners serving individual systems.

CONNECTIONS

General: Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.

Make connections with clean bare metal at points of contact.

Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.

Exothermic Welded Connections: Use for connections to structural steel and for underground connections. Install at connections to ground rods. Comply with manufacturer's written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.

Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.

Compression-Type Connections: Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.

Moisture Protection: Where insulated ground conductors are connected to ground rods or ground buses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.

END OF SECTION 260526

SECTION 260529 – SUPPORTING DEVICES

PART 1 – GENERAL

RELATED DOCUMENTS

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

Requirements of the following Division 26 Sections apply to this section:

Basic Electrical Requirements

SUMMARY

This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data for each type of product specified.

Hanger and support schedule showing manufacturer's figure number, size, spacing, features, and application for each required type of hanger, support, sleeve, seal, and fastener to be used.

Shop drawings indicating details of fabricated products and materials.

QUALITY ASSURANCE

Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

PART 2 – PRODUCTS

MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

Slotted Metal Angle and U-Channel Systems:

Allied Tube & Conduit
American Electric
B-Line Systems, Inc.
Cinch Clamp Co., Inc.
GS Metals Corp.
Haydon Corp.
Kin-Line, Inc.
Unistrut Diversified Products

Conduit Sealing Bushings:

Bridgeport Fittings, Inc.
Cooper Industries, Inc.
Elliott Electric Mfg. Corp.
GS Metals Corp.
Killark Electric Mfg. Co.
Madison Equipment Co.
L.E. Mason Co.
O-Z/Gedney
Producto Electric Corp.
Raco, Inc.
Red Seal Electric Corp.
Spring City Electrical Mfg. Co.
Thomas & Betts Corp.

COATINGS

Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

MANUFACTURED SUPPORTING DEVICES

Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

Fasteners: Types, materials, and construction features as follows:

Expansion Anchors: Carbon steel wedge or sleeve type.

Toggle Bolts: All steel springhead type.

Powder-Driven Threaded Studs: Heat-treated steel, designed specifically for the intended service.

Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

U-Channel Systems: 16-gage steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

FABRICATED SUPPORTING DEVICES

General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

Pipe Sleeves: Provide pipe sleeves of one of the following:

Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:

3-inch and smaller: 20-gage.

Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.

PART 3 – EXECUTION

INSTALLATION

Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

Coordinate with the building structural system and with other electrical installation.

Raceway Supports: Comply with the NEC and the following requirements:

Conform to manufacturer's recommendations for selection and installation of supports.

Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs, provide additional strength until there is a minimum of 200 lbs safety allowance in the strength of each support.

Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

Support parallel runs of horizontal raceways together on trapeze-type hangers.

Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

Space supports for raceways in accordance with Table I of this section. Space supports for raceway types not covered by the above in accordance with NEC.

Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.

Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, and other devices.

Sleeves: Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. For sleeves through fire rated-wall or floor construction, apply UL-listed firestopping sealant in gaps between sleeves and enclosed conduits and cables in accordance with "Fire Resistant Joint Sealers" requirement of Division 7 Section "Joint Sealers."

Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cabinets, panelboards, boxes, disconnect switches, and control components in accordance with the following:

Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.

Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.

Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock- resistant fasteners for attachments to concrete slabs.

TESTS: Test pull-out resistance of one of each type, size, and anchorage material for the following fastener types:

Expansion anchors.

Toggle bolts.

Power-driven threaded studs.

Provide all jacks, jigs, fixtures, and calibrated indicating scales required for reliable testing. Obtain the structural Engineer's approval before transmitting loads to the structure. Test to 90 percent of rated proof load for fastener. If fastening fails test, revise all similar fastener installations and retest until satisfactory results are achieved.

END OF SECTION 260529

SECTION 260533 – RACEWAYS

PART 1 – GENERAL

RELATED DOCUMENTS

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

Requirements of the following Division 26 Sections apply to this Section:

Basic Electrical Requirements

SUMMARY

This Section includes raceways for electrical wiring. Types of raceways in this section include the following:

Electrical metallic tubing (EMT).
Flexible metal conduit.
Intermediate metal conduit.
Liquidtight flexible conduit.
Rigid steel conduit.

Related Sections: The following Division 26 Sections contain requirements that relate to this Section:

Wires and Cables, for other wiring methods.
Supporting Devices, for raceway supports.
Electrical Boxes and Fittings, for boxes used with conduit and tubing systems.

Conduits larger than 1" shall be IMC or GRS.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product Data for the following products:

Surface raceway and fittings
Wireway and fittings
Power poles

QUALITY ASSURANCE

Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.

UL Compliance and Labeling: Comply with applicable requirements of UL standards pertaining to electrical raceway systems. Provide raceway products and components listed and labeled by UL, ETL, or CSA.

SEQUENCING AND SCHEDULING

Coordinate with other Work, as necessary to interface installation of electrical raceways and components with other Work.

PART 2 – PRODUCTS

MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

Conduit Bodies:

Adalet-PLM
American Electric
Appleton Electric Co.
Carlson
Crouse-Hinds Division, Cooper Industries, Inc.
Delta Industrial Products
Killark Electric Mfg. Co.
Kraloy Products Co.
O-Z/Gedney
Spring City Electrical Mfg. Co.

Surface Metal Raceway:

Allied Tube & Conduit
American Electric
B-Line Systems, Inc.
Erickson Electrical Equipment Co.
GS Metals Corp.
Haydon Corp.
Hoffman Engineering Co. Keystone/Rees, Inc.
SL Industries, Inc.
Square D Co.
The Wiremold Co.

METAL CONDUIT AND TUBING

Intermediate Steel Conduit: UL 1242.

Electrical Metallic Tubing and Fittings: ANSI C80.3.

Flexible Metal Conduit: UL 1, zinc-coated steel.

CONDUIT BODIES

General: Types, shapes, and sizes as required to suit individual applications and NEC requirements.

Provide matching gasketed covers secured with corrosion-resistant screws.

Metallic Conduit and Tubing: Use metallic conduit bodies. Use bodies with threaded hubs for threaded raceways.

Conduit Bodies 1 Inch and Smaller: Use bodies with compression-type EMT connectors.

PART 3 – EXECUTION

WIRING METHOD

Outdoors: Use the following wiring methods:

Exposed: Rigid steel conduit or IMC.

Concealed: Rigid steel conduit or IMC.

Indoors or Outdoors: Connection to vibrating equipment and hydraulic, pneumatic, or electric solenoid or motor-driven equipment in moist or humid location or corrosive atmosphere, or where subject to water spray or dripping oil, grease, or water: liquid tight flexible metal conduit.

Indoors: Use the following wiring methods:

Exposed: electrical metallic tubing, intermediate metal conduit.

Concealed: electrical metallic tubing.

INSTALLATION

General: Install electrical raceways in accordance with manufacturer's written installation instructions, applicable requirements of NEC, and as follows:

Conceal Conduit and EMT, unless indicated otherwise, within finished walls, ceilings, and floors. Keep raceways at least 6 inches away from parallel runs of flues or hot water pipes. Install raceways level and square and at proper elevations.

Elevation of Raceway: Where possible, install horizontal raceway runs above water piping.

Complete installation of electrical raceways before starting installation of conductors within raceways.

Provide supports for raceways as specified elsewhere in Division 26.

Prevent foreign matter from entering raceways by using temporary closure protection.

Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

Make bends and offsets so the inside diameter is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.

Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For rigid steel conduit and intermediate steel conduit, use threaded rigid steel conduit fittings except as otherwise indicated.

Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions except as otherwise indicated.

Install exposed raceways parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical.

Run exposed, parallel, or banked raceways together. Make bends in parallel or banked runs from the same center line so that the bends are parallel. Factory elbows may be used in banked

runs only where they can be installed parallel. This requires that there be a change in the plane of the run such as from wall to ceiling and that the raceways are of the same size. In other cases provide field bends for parallel raceways.

Join raceways with fittings designed and approved for the purpose and make joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Make raceway terminations tight. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors.

EMT connectors and couplings shall be compression type steel (not set screw), with insulated throat.

Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.

Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

Install pull wires in empty raceways. Use no. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.

Flexible Connections: Use short length (maximum of 6 ft.) of flexible conduit for recessed and semi-recessed lighting fixtures, for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet locations. Install separate ground conductor across flexible connections.

BURIED CONDUIT

Apply bituminous coating to all metallic conduits to be installed underground (two coats). Coating shall extend 6" above grade.

ADJUSTING AND CLEANING

Upon completion of installation of raceways inspect interiors of raceways; clear all blockages and remove burrs, dirt, and construction debris.

END OF SECTION 260533

SECTION 260553 – ELECTRICAL IDENTIFICATION

PART 1 – GENERAL

RELATED DOCUMENTS

Requirements of the following Division 26 Sections apply to this section:

Basic Electrical Requirements

SUMMARY

This Section includes identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including but not limited to the following:

Buried electrical line warnings
Identification labeling for raceways, cables, and conductors
Warning and caution signs
Equipment labels and signs

Related Sections: The following Sections contain requirements that relate to this Section:

Division 26 Section "Wires and Cables" for requirements for color coding of conductors for phase identification.

Refer to other Division 26 sections for additional specific electrical identification associated with specific items.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Specification Sections.

Product Data for each type of product specified.

Schedule of identification nomenclature to be used for identification signs and labels.

Samples of each color, lettering style, and other graphic representation required for identification materials, samples of labels and signs.

QUALITY ASSURANCE

Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

ANSI Compliance: Comply with requirements of ANSI Standard A13.1, "Scheme for the Identification of Piping Systems," with regard to type and size of lettering for raceway and cable labels.

PART 2 – PRODUCTS

MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

American Labelmark Co.
Calpico, Inc.
Cole-Flex Corp.
Emed Co., Inc.
George-Ingraham Corp.
Ideal Industries, Inc.
Kraftbilt
LEM Products, Inc.
Markal Corp.
National Band and Tag Co.
Panduit Corp.
Radar Engineers Div., EPIC Corp.
Seton Name Plate Co.
Standard Signs, Inc.
W.H.Brady, Co.

ELECTRICAL IDENTIFICATION PRODUCTS

Adhesive Marking Labels for Raceway and Metal-clad Cable: Pre-printed, flexible, self-adhesive labels with legend indicating voltage and service (Emergency, Lighting, Power, Light, Power d.c., Air Conditioning, Communications, Control, Fire). Label Size: as follows:

Raceways 1-Inch and Smaller: 1-1/8 inches high by 4 inches long.

Raceways Larger than 1-Inch: 1-1/8 inches high by 8 inches long.

Color: Black legend on orange background.

Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.

Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

Plasticized Card Stock Tags: Vinyl cloth with preprinted and field-printed legends to suit the application. Orange background, except as otherwise indicated, with Eyelet for fastener.

Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from minus 50 deg F to 350 deg F. Provide ties in specified colors when used for color coding.

PART 3 – EXECUTION

INSTALLATION

Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.

Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.

Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

Identify Junction, Pull, and Connection Boxes: Label outside of J-boxes with black permanent marker identifying system and circuit number of contained circuits.

Install line marker for underground wiring, both direct-buried and in raceway. Marker shall be 12" below finished grade.

Conductor Color Coding: Provide color coding for secondary service, feeder, and branch circuit conductors throughout the project secondary electrical system as follows:

<u>208y/120Volts</u>	<u>Phase</u>
Black	A
Red	B
Blue	C
White	Neutral
Green	Ground

Use conductors with color factory-applied the entire length of the conductors except as follows:

The following field-applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.

Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.

In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.

Tag or label conductors as follows:

Future Connections: Conductors indicated to be for future connection or connection under another contract with identification indicating source and circuit numbers.

Multiple Circuits: Where multiple branch circuits or control wiring or communications/signal conductors are present in the same box or enclosure (except for three-circuit, four-wire home runs), label each conductor or cable. Provide legend indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and voltage of branch circuit wiring may be indicated by mean of coded color of conductor insulation. For control and communications/signal wiring, use color coding or wire/cable marking tape at terminations and at intermediate locations where conductors appear in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.

Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

Install equipment/system circuit/device identification as follows:

Apply equipment identification labels of engraved plastic-laminate on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes communication/signal/alarm systems, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with 1/2-inch-high lettering on 1-1/2-inch-high label (2-inch-high where two lines are required), white lettering in black field. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply labels for each unit of the following categories of electrical equipment.

- Panelboards, electrical cabinets, and enclosures.
- Access doors and panels for concealed electrical items.
- Contactors.
- Control devices.

Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

Install labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

Junction Box Identification:

All new junction boxes shall be color coded by painting the cover as follows:

White	120/208V, 120/240V
Red	Fire Alarm

All power/lighting junction boxes shall have the panelboard and circuit number(s) written on the cover.

Conduit Identification:

Conduits shall be color coded every 10 feet by painting the conduit fittings according to the color scheme listed for junction boxes above.

END OF SECTION 260553

SECTION 262213 – DRY TYPE TRANSFORMERS

PART 1 – GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes general-purpose and specialty dry-type transformers with windings rated 600 V or less.

SUBMITTALS

General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.

Product data for each product specified, including dimensioned plans, sections, and elevations. Show minimum clearances and installed features and devices.

Wiring diagrams of products differentiating between manufacturer- installed and field-installed wiring.

Product certificates signed by manufacturers certifying that their products comply with the specified requirements.

Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of relevant completed projects with project names and addresses, and names and addresses of the respective Architects and Owners.

Product Test Reports: Certified copies of manufacturer's design and routine factory tests required by the referenced standards.

Sound Level Test Reports: Certified copies of manufacturer's sound level tests applicable to equipment for this Project.

Operation and maintenance data for materials and products to include in the "Operating and Maintenance Manual" specified in Division 01.

Field test reports of tests and inspections conducted according to Part 3 of this Section.

QUALITY ASSURANCE

Manufacturer Qualifications: A firm experienced in manufacturing components that comply with the requirements of these Specifications and that have a record of successful in-service performance.

Field-Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated.

Comply with NFPA 70 "National Electrical Code."

Comply with IEEE C2 "National Electrical Safety Code."

Listing and Labeling: Products are listed and labeled.

The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.

Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

DELIVERY, STORAGE, AND HANDLING

Temporary Heating: Apply temporary heat according to manufacturer's recommendations within the enclosure of each ventilated type unit throughout periods during which equipment is not energized and is not in a space that is continuously under normal control of temperature and humidity.

PART 2 – PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by the following:

Transformers:

Hevi-Duty Electric.
Siemens
Square D Co.
Cutler-Hammer

TRANSFORMERS, GENERAL

Transformers: Factory assembled and -tested, air-cooled units of types specified, designed for 60-Hz service.

Cores: Grain oriented, nonaging silicon steel.

Coils: Continuous windings without splices except for taps.

Internal Coil Connections: Brazed or pressure type.

GENERAL-PURPOSE, DRY-TYPE TRANSFORMERS

Comply with NEMA Standard ST 20 "Dry-Type Transformers for General Applications."

Transformers: Two winding type, 3-phase units using 1 coil per phase in primary and secondary. Transformers shall be non-linear rated K-13 minimum.

Windings: All copper.

Low Sound Level Units: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE Standard C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

Features and Ratings: As follows:

Enclosure: Indoor, ventilated, drip proof.

Insulation Class: 185 deg C or 220 deg C class for transformers 15 kVA or smaller; 220 deg C class for transformers larger than 15 kVA.

Insulation Temperature Rise: 80 deg C maximum rise above 40 deg C.

Taps: For transformers 3 kVA and larger, full capacity taps in high-voltage winding are as follows:

15 kVA through 500 kVA: Six 2.5-percent taps, 2 above and 4 below rated high voltage.

Accessories: The following accessory items are required:

Electrostatic Shielding: Insulated metallic shield between primary and secondary windings.

Connect shield to terminal marked "Shield" for grounding connection.

Capacitance: Arrange shield to provide a maximum of 33 picofarads primary-to-secondary capacitance over a frequency range of 20 Hz to 1 MHz.

Fungus Proofing: Permanent fungicidal treatment for coil and core.

Insulation Class: 185 deg C or 220 deg C class for transformers 15 kVA or smaller; 220 deg C class for transformers larger than 15 kVA.

Taps: Two 5-percent, full-capacity taps, 1 above and 1 below rated high voltage.

CONTROL AND SIGNAL TRANSFORMERS

Comply with NEMA Standard ST 1, "Specialty Transformers," and UL Standard 506, "Specialty Transformers."

Ratings: Continuous duty. Where rating is not indicated, provide capacity exceeding peak load by 50 percent minimum.

Type: Self-cooled, 2-winding, dry type.

Enclosure: Suitable for the location where installed.

PART 3 – EXECUTION

INSTALLATION

Arrange equipment to provide adequate spacing for access and for cooling air circulation.

Identify transformers and install warning signs according to Division 26 Section "Electrical Identification."

Tighten electrical connectors and terminals according to manufacturer's published torque tightening values. Where manufacturer's torque values are not furnished, use those specified in UL 486A and UL 486B.

GROUNDING

Ground transformers and systems served by transformers according to Division 26 Section "Grounding."

FIELD QUALITY CONTROL

Manufacturer's Field Services: Arrange and pay for the services of a factory-authorized service representative to supervise the field assembly and connection of components and pretesting and adjustment of adjustable voltage-regulating units.

Independent Testing Agency: Provide services of an independent electrical testing agency according to the requirements of Division 1 Section "Quality Control Services" to perform tests on installations made under this Section.

Test Objectives: To ensure transformer installation is operational within industry and manufacturer's tolerances, install according to Contract Documents, and suitable for energizing.

Test Labeling: Upon satisfactory completion of tests for each unit, attach a dated and signed "Satisfactory Test" label to the tested component.

Schedule tests and provide notification at least one week in advance of test commencement.

Report: Submit a written report of observations and tests. Report defective materials and workmanship.

Tests: Include the following minimum inspections and tests according to the manufacturer's instructions. Conform to IEEE Standard Test Code C57.12.91 for dry-type units, test method, and data correction factors.

Inspect accessible components for cleanliness, mechanical, and electrical integrity, for presence of damage or deterioration, and to ensure removal of temporary shipping bracing. Do not proceed with tests until deficiencies are corrected.

Include internal inspection through access panels and covers.

Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, where not available, those of UL standards 486A and 486B.

Insulation Resistance: Perform megohmmeter test of primary and secondary winding-to-winding and winding-to-ground. Use a minimum test voltage of 1,000V d.c. Minimum insulation resistance is 500 megohms.

Duration of Each Test: 10 minutes.

Temperature Correction: Correct results for test temperature deviation from 20 deg C standard.

Testing for Voltage Regulators: Perform same tests and inspections specified above for transformers. Include functional test throughout operating range of device. Check voltage tolerance, correction speed, and harmonic content of output for stepped changes in source voltage at 35 percent, 70 percent, and 100 percent of rated load.

Test Failures: Correct deficiencies identified by tests and retest. Verify that equipment meets the specified requirements.

ADJUSTING

After completing installation, cleaning, and testing, touch up scratches and mars on finish to match original finish.

Adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout the normal operating cycle of the facility. Record voltages and tap settings to submit with test results.

DEMONSTRATION

Adjustment and Training: Arrange and pay for factory-authorized service representatives to adjust and demonstrate voltage regulators and to conduct related training for Owner's maintenance personnel. Provide a minimum of 4 hours of training that include the following:

- Safety precautions.
- Features and construction of project equipment.
- Voltage adjustment procedures.
- Routine inspection and test procedures.
- Routine cleaning.
- Interpretation of readings of indicating and alarm devices.

Schedule training with at least 7 days' advance notice.

END OF SECTION 262213

SECTION 262416 – PANELBOARDS

PART 1 – GENERAL

RELATED DOCUMENTS

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

Requirements of the following Division 26 Sections apply to this Section:

Basic Electrical Requirements
Basic Electrical Materials and Methods

SUMMARY

This Section includes lighting and power panelboards and associated auxiliary equipment rated 600 V or less.

Related Sections: The following Division 26 Sections contain requirements that relate to this Section:

"Overcurrent Protective Devices" for circuit breakers, fusible switches, fuses, and other devices used in panelboards.

"Motor Controllers" for combination starters installed in panelboards.

DEFINITIONS

Load Center: A panelboard with thermal magnetic circuit-breaker branches, primarily of the plug-in type, designed for residential and light commercial projects, operating at 240 V and below, available in both single and 3-phase versions, and equipped with combination flush/surface mounting trim.

Overcurrent Protective Device (OCPD): A device operative on excessive current that causes and maintains the interruption of power in the circuit it protects.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data for each type panelboard, accessory item, and component specified.

Shop drawings from manufacturers of panelboards including dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:

Enclosure type with details for types other than NEMA Type 1.

Bus configuration and current ratings.

Short-circuit current rating of panelboard.

Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.

Wiring diagrams detailing schematic diagram including control wiring, and differentiating between manufacturer-installed and field-installed wiring.

Qualification data for field-testing organization certificates, signed by the Contractor, certifying that the organization complies with the requirements specified in Quality Assurance below. Include list of completed projects with project names, addresses, and names of Architect and Owner plus basic organization qualifications data.

Report of field tests and observations certified by the testing organization.

Panel schedules for installation in panelboards. Submit final versions after load balancing.

Maintenance data for panelboard components, for inclusion in Operating and Maintenance Manual specified in Division 1 and in Division 26 Section "Basic Electrical Requirements." Include instructions for testing circuit breakers.

QUALITY ASSURANCE

Listing and Labeling: Provide products specified in this Section that are listed and labeled.

The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.

Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code."

NEMA Standard: Comply with NEMA PB1, "Panelboards."

UL Standards: Comply with UL 61, "Panelboards," and UL 50, "Cabinets and Boxes."

EXTRA MATERIALS

Keys: Furnish six spares of each type for panelboard cabinet locks.

Touch-up Paint for surface-mounted panelboards: One half-pint container.

PART 2 – PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by the following:

Square D Co.
Siemens
Eaton

PANELBOARDS, GENERAL REQUIREMENTS

Neutral Bus Rating: The neutral bus for each panelboard shall be sized at 200% of main rating.

Overcurrent Protective Devices (OCPDs): Provide type, rating, and features as indicated. Comply with Division 26 Section "Overcurrent Protective Devices," with OCPDs adapted to panelboard installation. Tandem circuit breakers shall not be used. Multipole breakers shall have common trip.

Enclosures: Cabinets, flush or surface mounted as indicted. NEMA Type 1 enclosure, except where the following enclosure requirements are indicated.

Front: Secured to box with concealed trim clamps except as indicated. Cover shall be hinged lockable type. Front for surface-mounted panels shall be same dimensions as box. Fronts for flush panels shall overlap box except as otherwise specified.

Directory Frame: Metal, mounted inside each panel door.

Bus: Hard drawn copper of 98 percent conductivity.

Main and Neutral Lugs: Compression type.

Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box, except for isolated ground bus as indicated.

Service Equipment Approval: Listed for use as service equipment for panelboards having main service disconnect.

Provision for Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the OCPD ampere ratings indicated for future installation of devices.

Special Features: Provide the following features for panelboards.

Hinged Front Cover: Entire front trim hinged to box with standard door within hinged trim cover.

Skirt For Surface-Mounted Panels: Same gage and finish as panel front with flanges for attachment to panel, wall, and floor.

Feed-Through Lugs: Sized to accommodate feeders indicated.

Surge Arresters: IEEE C62.11, "Standards for Metal-Oxide Surge Arresters for AC Power Circuits," or IEEE C62.1, "Surge Arresters for Alternating Current Power Circuits."

Description: Coordinate impulse sparkover voltage with system circuit voltage and provide factory mounting with UL- recognized mounting device.

Circuit Breakers for Switching Lights at Panelboards: Indicated type SWD.

Circuit Breakers for Equipment Marked HCAR Type: Indicated HCAR type.

Interiors: Provide physical means to prevent installation of more OCPDs than the quantity for which the enclosure was listed.

Main, Neutral, and Ground Lugs and Buses: Have mechanical connectors for conductors.

LIGHTING AND APPLIANCE BRANCH CIRCUIT PANELBOARDS

Branch OCPDs: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

Doors: In panel front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.

DISTRIBUTION PANELBOARDS

Branch-Circuit Breakers: Where OCPDs are indicated to be circuit breakers, use bolt-on breakers except circuit breakers 225-ampere frame size and greater may be plug-in type where individual positive locking device requires mechanical release for removal.

Motor Starter Branches: Conform to Division 26 Section "Motor Controllers" and provide units equipped for panelboard mounting. Include the following accessories and pilot devices as indicated:

- Individual control power transformers.
- Fuses for control power transformers.
- Pilot lights.
- Extra interlock contacts.
- Pushbuttons.
- Selector switches.

Motor Starter Disconnects: Include overcurrent protection as indicated. Mount integral with or, in same panelboard, adjacent to motor starter. Mechanically interlock starter door with disconnect device. Provide auxiliary contacts on disconnect to deenergize control connections to starter.

ACCESSORY COMPONENTS AND FEATURES

Accessory Set: Include tools and miscellaneous items as required for overcurrent protective device test, inspection, maintenance, and operation.

Portable Test Set: Arranged to permit testing of functions of solid-state trip devices without removal from panelboard.

Fungus Proofing: Permanent fungicidal treatment for panelboards interior including OCPDs and other components.

IDENTIFICATION

General: Refer to Division 26 Section "Electrical Identification" for labeling materials.

Panelboard Nameplates: Engraved laminated plastic nameplate for each panelboard mounted with epoxy or industrial cement or industrial adhesive.

PART 3 – EXECUTION

INSTALLATION

General: Install panelboards and accessory items in accordance with NEMA PB 1.1, "General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less" and manufacturers' written installation instructions.

Mounting Heights: Top of trim 6'-2" above finished floor, except as indicated.

Mounting: Plumb and rigid without distortion of box. Mount flush panels uniformly flush with wall finish.

Circuit Directory: Typed and reflective of final circuit changes required to balance panel loads. Obtain approval before installing.

Install filler plates in unused spaces.

Provision for Future Circuits at Flush Panelboards: Stub four 1-inch empty conduits from panel into accessible ceiling space or space designated to be ceiling space in future. Stub four 1-inch empty conduits into raised floor space or below slab other than slabs on grade.

Auxiliary Gutter: Install where a panel is tapped to a riser at an intermediate location.

Wiring in Panel Gutters: Train conductors neatly in groups, bundle, and wrap with wire ties after completion of load balancing.

IDENTIFICATION

Identify field-installed wiring and components and provide warning signs in accordance with Division 26 Section "Electrical Identification."

GROUNDING

Connections: Make equipment grounding connections for panelboards as indicated.

Provide ground continuity to main electrical ground bus indicated.

CONNECTIONS

Tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturers published torque- tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

FIELD QUALITY CONTROL

Independent Testing Organization: Arrange and pay for the services of an independent electrical testing organization in to perform tests on low-voltage power panelboards and accessories.

Pretesting: Upon completing installation of the system, perform the following preparations for independent tests:

- Make insulation resistance tests of panelboard buses, components, and connecting supply, feeder, and control circuits.

- Make continuity tests of circuits.

- Provide set of Contract Documents to test organization. Include full updating on final system configuration and parameters where they supplement or differ from those indicated in original Contract Documents.

Quality Control Program: Conform to the following:

- Procedures: Make field tests and inspections and prepare panelboard for satisfactory operation in accordance with manufacturer's recommendations and these specifications.

- Protective Device Ratings and Settings: Verify indicated ratings and settings to be appropriate for final system configuration and parameters. Where discrepancies are found, recommend final protective device ratings and settings. Use accepted ratings or settings to make the final system adjustments.

Visual and Mechanical Inspection: Include the following inspections and related work:

- Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date drawings and panelboard schedules.

- Exercise and perform of operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.

- Check panelboard mounting, area clearances, and alignment and fit of components.

- Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.

Perform visual and mechanical inspection and related work for overcurrent protective devices as specified in Division 26 Section "Overcurrent Protective Devices."

Electrical tests: Include the following items performed in accordance with manufacturer's instruction:

Insulation resistance test of buses and portions of control wiring that disconnected from solid-state devices. Insulation resistance less than 100 megohms is not acceptable.

Ground resistance test on system and equipment ground connections.

Test main and subfeed overcurrent protective devices in accordance with Section "Overcurrent Protective Devices."

Retest: Correct deficiencies identified by tests and observations and provide retesting of panelboards by testing organization. Verify by the system tests that the total assembly meets specified requirements.

CLEANING

Upon completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

COMMISSIONING

Balancing Loads: After Substantial Completion, but not more than two months after Final Acceptance, conduct load-balancing measurements and circuit changes as follows:

Perform measurements during period of normal working load as advised by the Owner. Perform load-balancing circuit changes outside the normal occupancy/working schedule of the facility. Make special arrangements with Owner to avoid disrupting critical 24-hour services such as FAX machines and on-line data processing, computing, transmitting, and receiving equipment.

Recheck loads after circuit changes during normal load period. Record all load readings before and after changes and submit test records.

Tolerance: Difference between phase loads exceeding 20 percent at any one panelboard is not acceptable. Rebalance and recheck as required to meet this minimum requirement.

END OF SECTION 262416

SECTION 262716 – CABINETS, BOXES, AND FITTINGS

PART 1 – GENERAL

RELATED DOCUMENTS

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

Requirements of the following Division 26 Sections apply to this section:

Basic Electrical Requirements

SUMMARY

This section includes cabinets, boxes, and fittings for electrical installations and certain types of electrical fittings not covered in other sections. Types of products specified in this Section include:

Outlet and device boxes
Pull and junction boxes
Cabinets
Hinged door enclosures

Conduit-body-type electrical enclosures and wiring fittings are specified in Division 26 Section "Raceways."

DEFINITIONS

Cabinets: An enclosure designed either for surface or for flush mounting and having a frame, or trim in which a door or doors may be mounted.

Device Box: An outlet box designed to house a receptacle device or a wiring box designed to house a switch.

Enclosure: A box, case, cabinet, or housing for electrical wiring or components.

Outlet Box: A wiring enclosure where current is taken from a wiring system to supply utilization equipment.

Wiring Box: an enclosure designed to provide access to wiring systems or for the mounting of indicating devices or of switches for controlling electrical circuits.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

Product data for cabinets and enclosures with classification higher than NEMA 1.

Shop drawings for floor boxes and boxes, enclosures and cabinets that are to be shop fabricated (nonstock items). For shop fabricated junction and pull boxes, show accurately scaled views and spatial relationships to adjacent equipment. Show box types, dimensions, and finishes.

QUALITY ASSURANCE

UL Listing and Labeling: Items provided under this section shall be listed and labeled by UL.

Nationally Recognized Testing Laboratory Listing and Labeling (NRTL): Items provided under this section shall be listed and labeled by a NRTL. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

National Electrical Code Compliance: Components and installation shall comply with NFPA 70 "National Electrical Code."

NEMA Compliance: Comply with NEMA Standard 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."

PART 2 – PRODUCTS

MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

Cabinets:

Electric Panelboard, Inc.
Erickson Electrical Equipment Co.
Hoffman Engineering Co.
Parker Electrical Mfg. Co.
Spring City Electrical Mfg. Co.
Square D Co.

CABINETS, BOXES, AND FITTINGS, GENERAL

Electrical Cabinets, Boxes, and Fittings: Of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations.

MATERIALS AND FINISHES

Sheet Steel: Flat-rolled, code-gage, galvanized steel.

Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.

Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.

Cast Metal for Boxes, Enclosures, and Covers: Copper-free aluminum except as otherwise specified.

Exterior Finish: Gray baked enamel for items exposed in finished locations except as otherwise indicated.

Painted Interior Finish: Where indicated, white baked enamel.

Fittings for Boxes, Cabinets, and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connectors.

METAL OUTLET, DEVICE, AND SMALL WIRING BOXES

General: Conform to UL 514A, "Metallic Outlet Boxes, Electrical," and UL 514B, "Fittings for Conduit and Outlet Boxes." Boxes shall be of type, shape, size, and depth to suit each location and application.

Steel Boxes: Conform to NEMA OS 1, "Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports." Boxes shall be sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.

Cast-Aluminum Boxes: Copper free aluminum threaded raceway entries, and features and accessories suitable for each location including mounting ears, threaded screw holes for devices and closure plugs.

PULL AND JUNCTION BOXES

General: Comply with UL 50, "Electrical Cabinets and Boxes", for boxes over 100 cubic inches volume. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.

Hot-Dipped Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing. Hot-dip galvanized after fabrication. Cover shall be gasketed.

CABINETS

Comply with UL 50, "Electrical Cabinets and Boxes."

Construction: Sheet steel, NEMA 1 class except as otherwise indicated. Cabinet shall consist of a box and a front consisting of a one-piece frame and a hinged door. Arrange door to close against a rabbet placed all around the inside edge of the frame, with a uniform close fit between door and frame. Provide concealed fasteners, not over 24-inches apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door hinges not over 24-inches apart and not over 6-inches from top and bottom of door. For flush cabinets, make the front approximately 3/4 inch larger than the box all around. For surface mounted cabinets make front same height and width as box.

Locks: Combination spring catch and key lock, with all locks for cabinets of the same system keyed alike. Locks may be omitted on signal, power, and lighting cabinets located within wire closets and mechanical electrical rooms. Locks shall be of a type to permit doors to latch closed without locking.

Mounting Panel: Provide painted removable internal mounting panel for component installation.

PART 3 – EXECUTION

INSTALLATION, GENERAL

Locations: Install items where indicated and where required to suit code requirements and installation conditions.

Devices shall be mounted as indicated below:

light switch - 48" AFF to top of operator
receptacles - 18" " " "
voice/data/telephone - 18" AFF to C.L.

Devices shown above work surface shall be mounted 2" above backsplash or work surface, whichever is higher.

Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.

Support and fasten items securely in accordance with Division 26 Section "Supporting Devices."

Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated.

Remove sharp edges where they may come in contact with wiring or personnel.

APPLICATIONS

Cabinets: Surface mounted NEMA enclosure type 1 except as otherwise indicated.

Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements.

Interior Dry Locations: Sheet steel, NEMA type 1.

Locations Exposed to Weather or Dampness: Cast metal, NEMA type 3R.

Wet Locations: NEMA type 4 enclosures.

Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location except as otherwise indicated.

INSTALLATION OF OUTLET BOXES

Outlets at Windows and Doors: Locate close to window trim. For outlets indicated above doors use 6' - 9" mounting height above finished floor and center outlets above the door opening except as otherwise indicated.

Column and Pilaster Locations: Locate outlet boxes for switches and receptacles on columns or pilasters so the centers of the columns are clear for future installation of partitions.

Locations in Special Finish Materials: For outlet boxes for receptacles and switches mounted in desks or furniture cabinets or in glazed tile, concrete block, marble, brick, stone or wood walls, use rectangular shaped boxes with square corners and straight sides. Install such boxes without plaster rings. Saw cut all recesses for outlet boxes in exposed masonry walls.

Gasketed Boxes: At the following locations use cast metal, threaded hub type boxes with gasketed weatherproof covers:

Exterior locations.

Where surface mounted on unfinished walls, columns or pilasters.

(Cover gaskets may be omitted in dry locations).

Where exposed to moisture laden atmosphere.

At food preparation equipment within four ft. of steam connections.

Where indicated.

Mounting: Mount outlet boxes for switches with the long axis vertical or as indicated. Mount boxes for receptacles either vertically or horizontally but consistently either way. Three or more gang boxes shall be mounted with the long axis horizontal. Locate box covers or device plates so they

will not span different types of building finishes either vertically or horizontally. Locate boxes for switches near doors on the side opposite the hinges and close to door trim, even though electrical floor plans may show them on hinge side.

Ceiling Outlets: For fixtures, where wiring is concealed, use outlet boxes 4-inches square by 1-1/2-inches deep, minimum.

Cover Plates for Surface Boxes: Use plates sized to box front without overlap.

Protect outlet boxes to prevent entrance of plaster, and debris. Thoroughly clean foreign material from boxes before conductors are installed.

INSTALLATION OF PULL AND JUNCTION BOXES

Box Selection: For boxes in main feeder conduit runs, use sizes not smaller than 8-inches square by 4-inches deep. Do not exceed 6 entering and 6 leaving raceways in a single box.

Cable Supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30-inches inside boxes.

Mount pull boxes in inaccessible ceilings with the covers flush with the finished ceiling.

Size: Provide pull and junction boxes for telephone, signal, and other systems at least 50 percent larger than would be required by Article 370 of NEC, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

INSTALLATION OF CABINETS

Mount with fronts straight and plumb.

Install with tops 78-inches above floor.

Set cabinets in finished spaces flush with walls.

GROUNDING

Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the cabinet, box or enclosure.

CLEANING AND FINISH REPAIR

Upon completion of installation, inspect components. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, abrasions and weld marks.

Galvanized Finish: Repair damage using a zinc-rich paint recommended by the tray manufacturer.

Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating.

END OF SECTION 262716

SECTION 262726 - WIRING DEVICES

PART 1 – GENERAL

RELATED DOCUMENTS

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

Requirements of the following Division 26 Sections apply to this section:

Basic Electrical Requirements

SUMMARY

This Section includes the following:

Receptacles
Snap Switches
Wall Plates

Related Sections: The following sections contain requirements that relate to this section:

Division 26 Section "Circuit and Motor Disconnects" for devices other than snap switches and plug/receptacle sets used as disconnects for motors.

SUBMITTALS

Product data for each type of product specified.

Samples of those products indicated for sample submission in Architect's comments on product data submittal. Include color and finish of device plates and other items per Architect's request.

QUALITY ASSURANCE

Regulatory Requirements: Comply with provisions of the following codes:

NFPA 70 "National Electrical Code ".

UL and NEMA Compliance: Provide wiring devices which are listed and labeled by UL and comply with applicable UL and NEMA standards.

SEQUENCE AND SCHEDULING

Schedule installation of finish plates after the surface upon which they are installed has received final finish.

PART 2 – PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Bryant Electric Co.
Challenger-Circle F
Crouse-Hinds Co.

Eagle Electric Mfg. Co.
General Electric Co.
Hubbell Inc.
Pass and Seymour Inc.
Slater Electric Co.
Square D Co.
Steel City; Midland-Ross Corp.
Leviton

WIRING DEVICES:

General: Provide wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD 1 and other applicable UL and NEMA standards. Provide ivory color devices and wall plates except as otherwise indicated. Verify color selections with Architect.

Receptacles: As scheduled in Table 1 in Part 3 below. Comply with UL 498 and NEMA WD 1.

Receptacles, Industrial Heavy Duty: Provide pin and sleeve design receptacles conforming to UL 498. Comply with UL 1010 where installed in hazardous locations. Provide features indicated.

Snap Switches: quiet type AC switches as indicated in Table 2 in Part 3 below. Comply with UL 20 and NEMA WD1.

WIRING DEVICE ACCESSORIES

Wall Plates: single and combination, of types, sizes, and with ganging and cutouts as indicated. Provide plates which mate and match with wiring devices to which attached. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Provide wall plate color to match wiring devices except as otherwise indicated. Provide wall plates with engraved legend where indicated. Conform to requirements of Section "Electrical Identification." Provide plates possessing the following additional construction features:

Material and Finish: Brushed stainless steel.

PART 3 – EXECUTION

INSTALLATION OF WIRING DEVICES AND ACCESSORIES

Install wiring devices and accessories as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.

Coordinate with other Work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other Work.

Install wiring devices only in electrical boxes which are clean; free from building materials, dirt, and debris.

Install wiring devices after wiring work is completed.

Install wall plates after painting work is completed.

Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's

torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A. Use properly scaled torque indicating hand tool.

PROTECTION

Protect installed components from damage. Replace damaged items prior to final acceptance.

FIELD QUALITY CONTROL

Testing: Prior to energizing circuits, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements, operating each operable device at least six times.

Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer recommendations.

TABLE 1 (See Evaluations, Ref 3)

RECEPTACLES

DESIG- NATION (1)	CURRENT RATING AMPS	VOLTAGE RATING	SINGLE/ DUPLEX	NEMA CONFIG- URATION	UL GRADE	NOTES
-	20	125	DUPLEX	5-20R	HEAVY DUTY	
C	15	125	SINGLE	5-20R	GEN. DUTY	(2)
WP	20	125	DUPLEX	5-20R	HEAVY DUTY	INTEGRAL
GFI						
GHI (3)						

NOTES

(1) Letter designations are used where symbols alone do not clearly designate on plans locations where specific receptacle types are used.

(2) Protects downstream receptacles on same circuit.

TABLE 2 (See Evaluations, Ref 3)

SNAP SWITCHES

DESIG- NATION (1) (AC)	TYPICAL LOAD APPLICATION	VOLTAGE RATING	POLES RATING	UL GRADE	NOTES
S	CONTROL LIGHTS	20A	120/277	1	HEAVY DUTY
S3	CONTROL LIGHTS	20A	120/277	3-way	HEAVY DUTY
S	DISCONN. MOTOR	1HP	120/277	1	HEAVY DUTY (2)
SD	DIMMER SWITCH	600W	120	1	HEAVY DUTY (4)

NOTES

(1) For snap switches, designation is the same as the symbol used on plans for the device. Type of switch is determined from plan context including type of device or circuit being controlled.

(2) No overload element in switch.

(3) Derate dimmer switch per manufacturer's recommendations where dimmers are ganged together.

END OF SECTION 262726

SECTION 262813 – FUSES

PART 1 – GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to the work of this section.

SUMMARY

Extent of fuse work required by this section is indicated by drawings, and by requirements of this section.

SYSTEM DESCRIPTION

Types of fuses specified in this section include the following:

Class RK1 time-delay.
Class RK 5 time-delay.

SUBMITTALS

Product Data: Submit manufacturer's technical product data on fuses, including specifications, electrical characteristics, installation instructions, furnished specialties and accessories. In addition, include voltages and current ratings, interrupting ratings, current limitation ratings, time-current trip characteristic curves, and mounting requirements.

QUALITY ASSURANCE

Manufacturer's Qualifications: Firms regularly engaged in manufacture of fuses of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

Codes and Standards:

UL Compliance and Labeling: Comply with applicable provisions of UL 198D, "High-Interrupting-Capacity Class K Fuses". Provide overcurrent protective devices which are UL-listed and labeled.

NEC Compliance: Comply with NEC as applicable to construction and installation of fuseable devices.

ANSI Compliance: Comply with applicable requirements of ANSI C97.1 "Low-Voltage Cartridge Fuses 600 Volts or Less".

MAINTENANCE

Maintenance Stock, Fuses: For types and ratings required, furnish additional fuses, amounting to one unit for every 5 installed units, but not less than one set of 3 of each kind.

PART 2 – PRODUCTS

MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering fuseable devices which may be incorporated in the work include, but are not limited to, the following:

Bussmann Div; Cooper Industries.
General Electric Co.
Shawmut Div; Gould Inc.
Reliance Fuse Div;
Littlefuse, Inc.

FUSES

General: Except as otherwise indicated, provide fuses of types, sizes, ratings, and average time-current and peak let-through current characteristics indicated, which comply with manufacturer's standard design, materials, and constructed in accordance with published product information, and with industry standards and configurations.

Class RK1 Current Limiting Fuses: Provide UL Class RK1 current-limiting fuses rated 600-volts, 60 Hz, size as indicated in drawings, with 200,000 RMS symmetrical interrupting current rating for protecting circuit-breakers.

Class RK5 Time Delay Fuses: Provide UL Class RK5 time-delay fuses rated 600-volts, 60 Hz, size as indicated in drawings, with 200,000 RMS symmetrical interrupting current rating for protecting motors.

PART 3 – EXECUTION

EXAMINATION

Examine areas and conditions under which fuses are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to Installer.

INSTALLATION OF FUSES

Install fuses as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of fuses.

Coordinate with other work, including electrical wiring, as necessary, to interface installation of fuses with other work.

Install fuses in fused switches, if any.

FIELD QUALITY CONTROL

Prior to energization of fusible devices, test devices for continuity of circuitry and for short-circuits. Replace malfunctioning units with new units, and then demonstrate compliance with requirements.

END OF SECTION 262813

SECTION 262816 – CIRCUIT BREAKERS

PART 1 – GENERAL

Division 26 Basic Electrical Materials and Methods sections apply to work of this section.

SUMMARY

Extent of circuit-breaker (CB) work is indicated by drawings and schedules.

Types of circuit breakers in this section include the following:

Molded-case

Refer to other Division 26 sections for wires/cables and connector work required in conjunction with CB protective devices; not work of this section.

SUBMITTALS

Product Data: Submit manufacturer's product data and installation instructions for circuit breakers.

Wiring Diagrams: Submit wiring diagrams for circuit breakers and accessories showing connections to electrical power feeders and associated equipment. Differentiate between portions of wiring which are manufacturer-installed and portions which are field-installed.

Certification: Submit certified test data which indicates current-interrupting ratings for each circuit breaker.

QUALITY ASSURANCE

Manufacturer's Qualifications: Firms regularly engaged in manufacture of circuit breakers of types, ratings, and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects utilizing circuit-breaker devices similar to those required for this project.

Codes and Standards:

Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction, and NEC as applicable to construction and installation of circuit breakers.

UL Compliance: Comply with applicable requirements of UL 486A, 489 and 1066 which apply to construction and installation of circuit breakers.

NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub/No.'s AB 1, 2 and 3, SG 3 and 250.

FS Compliance: Comply with Federal Specification W-C-375B/GEN pertaining to molded-case circuit breakers.

DELIVERY, STORAGE AND HANDLING

Deliver circuit breakers and components in factory-fabricated type containers or wrappings, which properly protect devices from damage.

Store circuit breakers in original packaging and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.

Handle circuit breakers carefully to prevent physical damage to CBs and components. Do not install damaged CBs; remove from site and replace damaged devices with new.

PART 2 – PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide circuit-breaker devices of one of the following (for each type and rating of circuit breaker):

Siemens
Square D Company.
Cutler Hammer

CIRCUIT BREAKERS

General: Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for a complete installation.

Molded-Case Circuit Breakers: Provide factory assembled, molded case circuit breakers of frame sizes indicated; rated as indicated on drawings. Provide breakers with permanent thermal and instantaneous magnetic trips in each pole, and with fault-current limiting protection, ampere ratings as indicated. Construct with over center, trip-free, toggle-type operating mechanisms with quick-make, quick-break action and positive handle trip indication. Provide push-to-trip button on enclosure cover for mechanically tripping circuit breakers. Construct breakers for mounting and operating in any physical position and operating in an ambient temperature of 40 deg C. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.

PART 3 – EXECUTION

EXAMINATION

Examine areas and conditions under which circuit breakers are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

INSTALLATION OF CIRCUIT BREAKERS

Install circuit breakers and accessories as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with requirements of NEC, and applicable portions of NECA's "Standard of Installation" pertaining to installation of circuit breakers and general wiring practices.

Coordinate with other work, including electrical wiring work, as necessary to interface installation of circuit breaker work with other work.

Fasten circuit breakers without causing mechanical stresses, twisting or misalignment being exerted by clamps, supports, or cabling.

Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A.

ADJUST AND CLEAN

Inspect circuit-breaker operating mechanisms for malfunctioning and, where necessary, clean and adjust units for free mechanical movement.

GROUNDING

Provide equipment grounding connections for circuit breakers as indicated. Tighten connectors to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounding.

FIELD QUALITY CONTROL

Upon completion of installation and after circuitry has been energized, demonstrate capability and compliance of system with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting. Testing and retesting at no cost to Owner.

END OF SECTION 262816

SECTION 262923 – MOTOR CONTROLLERS

PART 1 – GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

SUMMARY

Extent of motor controller work is indicated by drawings and schedules.

Types of motor controllers specified in this section include the following:

Combination

Work of this section includes wires/cables, raceways, electrical boxes and fittings, as specified in Division 26 Basic Electrical Materials and Methods sections, and used in conjunction with motor controllers.

Refer to applicable Division 26, Basic Electrical Materials and Methods sections for wires/cables, electrical raceways, and boxes and fittings required in connection with motor controllers.

SUBMITTALS

Product Data: Submit manufacturer's data and installation instructions on motor controllers.

Shop Drawings: Submit shop drawings of motor controllers showing accurately scaled equipment locations and spatial relationships to associated motors and equipment.

Wiring Diagrams: Submit power and control wiring diagrams for motor controllers showing connections to electrical power panels, feeders, and equipment. Differentiate between portions of wiring which are manufacturer-installed and portions which are field-installed.

QUALITY ASSURANCE

Manufacturer's Qualifications: Firms regularly engaged in manufacture of motor controllers of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing motor controller work similar to that required for this project.

Codes and Standards:

Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC Articles 220, 250, and 430, as applicable to installation, and construction of motor controllers.

NFPA Compliance: Comply with applicable requirements of NFPA 70E, "Standard for Electrical Safety Requirements for Employee Workplaces."

UL Compliance: Comply with applicable requirements of UL 486A and B, and UL 508, pertaining to installation of motor controllers. Provide controllers and components which are UL-listed and labeled.

IEEE Compliance: Comply with recommended practices contained in IEEE Standard 241, "Recommended Practice for Electric Power Systems in Commercial Buildings," pertaining to motor controllers.

NEMA Compliance: Comply with applicable requirements of NEMA Standard ICS 2, "Industrial Control Devices, Controllers and Assemblies", and Pub No. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)", pertaining to motor controllers and enclosures.

PRODUCT DELIVERY, STORAGE, AND HANDLING

Deliver motor controllers and components properly packaged in factory-fabricated type containers.

Store motor controllers and components in original packaging and in a clean dry space; protect from weather and construction traffic.

Handle motor controllers and components carefully to avoid breakages, impacts, denting and scoring finishes. Do not install damaged equipment; replace and return damaged units to equipment manufacturer.

SEQUENCING AND SCHEDULING

Coordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of motor controllers with other work.

Sequence motor controller installation work with other work to minimize possibility of damage and soiling during remainder of construction period.

MAINTENANCE

Maintenance Data: Submit maintenance data and parts list for each motor controller and component; including "trouble shooting" maintenance guide. Include that data, product data and shop drawings in a maintenance manual; in accordance with requirements of Division 1.

Maintenance Stock, Fuses: For types and ratings required, furnish additional fuses, amounting to one unit for every 10 installed units, but not less than 5 units of each.

PART 2 – PRODUCTS

MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering motor controllers which may be incorporated in the work include, but are not limited to, the following:

Allen-Bradley Co.
Appleton Electric Co.; Subsidiary of Emerson Electric Co.
Crouse-Hinds Co.
Cutler Hammer Products, Eaton Corp.
Square D Company

MOTOR CONTROLLERS

General: Except as otherwise indicated, provide motor controllers and ancillary components which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation.

Combination Controllers: Provide fusible type full-voltage alternating- current combination controllers, consisting of controller and disconnect switch mounted in common enclosure, of types,

sizes, ratings, and NEMA sizes indicated. Equip controllers with electrical and mechanical interlocks to prevent both forward and reverse contactors closing simultaneously. Equip controllers with block type manual reset overload relays and with fusible disconnect switches. Provide operating handle for disconnect switch mechanism with indication and control of switch position, with enclosure door either opened or closed, and capable of being locked in OFF position with three padlocks. Construct and mount controllers and disconnect switches in single NEMA Type 1 enclosure; coat with manufacturer's standard color finish.

PART 3 – EXECUTION

EXAMINATION

Examine areas and conditions under which motor controllers are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

INSTALLATION OF MOTOR CONTROLLERS

Install motor controllers where indicated, in accordance with equipment manufacturer's written instructions and with recognized industry practices; complying with applicable requirements of NEC, UL and NEMA standards, to insure that products fulfill requirements.

Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and B, and the National Electrical Code.

Install fuses, of sizes indicated, in each fusible disconnect switch, if any.

FIELD QUALITY CONTROL

Prior to energization of motor controller equipment, check with ground resistance tester, phase to phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

Prior to energization, check circuitry for electrical continuity, and for short-circuits.

Ensure that direction of rotation of each motor fulfills requirements.

GROUNDING

Provide equipment grounding connections for motor controller equipment as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

ADJUSTING AND CLEANING

Adjust operating mechanisms, where necessary, for free mechanical movement.

Touch-up scratched or marred enclosure surfaces to match original finishes.

DEMONSTRATION

Upon completion of installation of motor controller equipment and electrical circuitry, energize controller circuitry and demonstrate functioning of equipment in accordance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and retest to demonstrate compliance.

END OF SECTION 262923

SECTION 263353 – SINGLE-MODULE UNINTERRUPTIBLE POWER SYSTEM 60kw (60kVA)

PART 1 - GENERAL

SUMMARY:

These specifications describe requirements for an Uninterruptible Power System (UPS) optimized for maximum efficiency. The UPS shall automatically maintain AC power to the critical load within specified tolerances and without interruption during failure or deterioration of the normal power source.

The manufacturer shall design and furnish all materials and equipment to be fully compatible with electrical, environmental and space conditions at the site. The UPS shall include all equipment to properly interface the AC power source to the intended load and shall be designed for unattended operation.

Basis of Design is Liebert EXM. Other acceptable manufacturer is Mitsubishi.

The UPS system shall be factory built, UL listed and supplied complete for the intended purpose. UPS system shall be dual feed with one output. UPS system shall consist of three side-by-side factory connectable cabinets (maintenance bypass cabinet, UPS module cabinet and battery cabinet).

STANDARDS

The UPS and all associated equipment and components shall be manufactured in accordance with the following applicable standards:

The UPS shall be UL listed per UL Standard 1778, Fourth edition, Uninterruptible Power Supplies, and shall be CSA Certified.

The UPS shall be provided with a Short Circuit Withstand Rating (SCWR) label denoting the maximum source fault short circuit current that is applicable to the unit. The withstand rating shall be independently verified by a nationally recognized, third-party lab.

The UPS shall withstand input surges to both the rectifier and bypass when configured as a dual-input unit without damage as per the criteria in EN62040-2 (4kV). The manufacturer shall provide evidence of compliance upon request.

The UPS shall comply with FCC Rules and Regulations, Part 15, Subclass B, Class A. This compliance is legally required to prevent interference with adjacent equipment. The UPS shall have a label stating FCC compliance. The manufacturer shall provide evidence and test data of compliance upon request.

The UPS shall be compatible with the wiring practices, materials and coding in accordance with the requirements of the National Electrical Code, OSHA and applicable local codes and standards. Provisions shall be made in the cabinets to permit installation of input, output and external control cabling using raceway or conduit for top and bottom access to input, output, bypass and DC connections. Connection cabinets shall provide for wiring gutter and wire bend radius as defined by the NEC and UL.

SYSTEM DESCRIPTION

Design Requirements:

The UPS shall be sized to provide a minimum of 60kW output (unity load power factor rating).

The UPS shall be able to supply all required power to full rated output kVA loads with power factor from 0.5 lagging to unity. The UPS shall also work from unity power factor to 0.5 leading power factors subject to derating.

Load voltage and bypass line voltage shall be 208VAC, three-phase, four-wire plus ground.

Input voltage shall be 208VAC, three-phase, four-wire plus ground. The AC input source and bypass input source shall each be a solidly grounded wye service.

The rectifier AC input and bypass AC input may be fed from separate AC sources with the use of an optional Liebert eXM Dual Transformer Cabinet.

The battery shall support the UPS at 100% rated kW load for at least ten minutes at 77°F (25°C) at startup.

The UPS shall have an active power factor-corrected IGBT converter/rectifier, capable of maintaining input power factor and input current total harmonic distortion (THDi) within specifications without an additional input filter.

The UPS shall be of transformer-free design, requiring no internal transformer in the main power path for the basic operation of the module. Optional transformers in cabinets or otherwise external to the basic UPS module shall be permissible to provide isolation and/or voltage transformation.

The UPS system shall consist of three side-by-side factory wired, field connected dead front cabinets (maintenance bypass cabinet, UPS module / static bypass cabinet, and battery cabinet).

Maintenance Bypass Cabinet: (Fully rated 60kw (60kVA) 120/208, 3Ø, 4W) Dead front free standing construction with hinged lockable cover panels (front access only) with incoming terminal lugs, (3) 400A, 65k, 3p circuit breakers, frame fully adjustable (LSI) down to 40% of frame rating (set @ 200A LT), (BIB, MBB, and MIB) and output lugs / busbar. Bussing and interconnections shall be factory provided. Unit shall have a 65k AIC rating. Interconnections between cabinets shall be done using UL listed factory connectors.

UPS Module Cabinet: (Fully rated 60kw (60kVA) 120/208, 3Ø, 4W) Dead front free standing with hinged lockable cover panels (front access only) with incoming lugs and outgoing lugs. Unit shall include static bypass, inverter / rectifiers. Bussing and interconnections to maintenance bypass cabinet and battery cabinet shall be factory provided by UL listed connectors. This module shall include digital interface and readout / controls panels.

Battery Cabinet: (Fully rated for 10 minutes) Dead front free standing with hinged lockable cover panels (front access only) with incoming lugs, overcurrent device and batteries. Interconnections to UPS module shall be factory provided by UL listed connectors.

Complete unit shall be no larger than shown on the engineering documents. Height of unit shall be as indicated in this specification.

Modes of Operation: The UPS shall operate as an on-line reverse transfer system in the following modes:

Normal: The critical AC load shall be continuously powered by the UPS inverter. The rectifier/charger shall derive power from the utility AC source and supply DC power to the DC-DC converter, which in turn shall supply the inverter while simultaneously float charging the battery.

ECO Mode: The critical AC load shall be continuously powered by the bypass with the inverter available to power the load if the bypass source voltage or frequency exceeds adjustable parameters of power quality.

Battery: Upon failure of utility AC power, the critical load shall be powered by the inverter, which, without any switching, shall obtain its power from the battery plant via the DC-DC converter. There shall be no interruption in power to the critical load upon failure or restoration of the utility AC source.

Recharge: Upon restoration of the utility AC source, the rectifier shall supply power to the output inverter and to the DC-DC converter, which shall simultaneously recharge the batteries. This shall be an automatic function and shall cause no interruption to the critical load.

Bypass: If the UPS must be taken out of service, the static transfer switch shall transfer the load to the bypass source. The transfer process shall cause no interruption in power to the critical load. An optional external wrap-around maintenance bypass shall be used to ensure full isolation of the unit for the service of internal components while providing safety from arc flash and in compliance with OSHA requirements.

Off-Battery: If the battery only is taken out of service, it shall be disconnected from the DC-DC converter by means of an external disconnect circuit breaker (in the case of external batteries). The UPS shall continue to function and meet all of the specified steady-state performance criteria, except for the power outage backup time capability. If multiple battery strings are used, each string shall be capable of being electrically isolated for safety during maintenance.

Performance Requirements:

The solid-state power components, magnetics, electronic devices and overcurrent protection devices shall operate within the manufacturer's recommended temperature when the UPS is operating at 100% critical load and maintain battery charging under either of the following conditions:

Any altitude within the specified operating range up to 3300 ft. (1000m) elevation.

Any ambient temperature within the specified operating range of 32°F to 104°F (0°C to 40°C)

Input:

Voltage: Input/output voltage specifications of the UPS shall be:

Rectifier AC Input: 208V, three-phase, four-wire-plus-ground

Bypass AC Input: 208V, three-phase, four-wire-plus-ground

AC Output: 208V, three-phase, four-wire-plus-ground

Voltage Range: +20%, -15% at full load; -40% at half load

Frequency Range: 40 - 70Hz

Maximum Inrush Current: UPS inrush current not to exceed 1.5 times rated input current

Power Factor: Minimum 0.99 at full load with nominal input voltage

Current Distortion: Less than 5% THD at full load input current in double-conversion mode.

Surge Protection: Withstands input surges of 4kV (Line to ground) without damage as per criteria listed in EN 61000-4-5: 1995

Short Circuit Current Rating: Units shall carry as standard 65kA Short Circuit Withstand Rating. All ratings shall be certified and a label shall be applied to the unit clearly identifying this rating as required by the National Electrical Code.

AC Output:

Load Rating: 100% of load rating at 104°F (40°C) for any load from 0.5 lagging to unity

Voltage Regulation:

±1% RMS average for a balanced, three-phase load
±2% for 100% unbalanced load for line-to-line imbalances

Voltage Adjustment Range: ±5% for line drop compensation adjustable by factory service personnel.

Frequency Regulation:

Synchronized to bypass: ±2.0Hz default setting, (adjustable by factory service personnel)

System Efficiency (defined as output kW/input kW at rated lagging load power factor; and not less than the values listed below:

Phase Imbalance:

Balanced loads	120° ±1°
100% unbalanced loads	120° ±2°

Voltage Transients (average of all three phases):

0-100% or 100-0%	
Response	Meets IEC 62040-3: 2010 Figure 2 Curve 1, Class 1 Meets ITIC and CBEMA Curve Requirements

10-100% or 100-10%	
Transient Voltage Deviation, RMS	5%

Overload at Full Output Voltage with ±1% voltage regulation:

100% continuously
105% - 110% of full load for 60 minutes at 104°F (40°C) ambient
110% - 125% of full load for 10 minutes at 104°F (40°C) ambient
125% - 150% of full load for 60 seconds at 104°F (40°C) ambient
>150% of full load for a minimum of 200 milliseconds at 104°F (40°C) ambient

Grounding: The UPS chassis shall have an equipment ground terminal.

ENVIRONMENTAL CONDITIONS

The UPS shall be able to withstand the following environmental conditions without damage or degradation of operating characteristics:

Operating Ambient Temperature:

UPS: 32°F to 104°F (0°C to 40°C) without derating

Battery: 77°F (25°C), ±5°F (±3°C)

Storage/Transport Ambient Temperature:

-4°F to 158°F (-20°C to 70°C)

Relative Humidity:

0 to 95%, non-condensing

Altitude:

Operating: To 3300 ft. (1000m) above Mean Sea Level without derating (compliant with IEC/EN 62040-3 at altitudes exceeding 1000m)

Consult factory for derating above 3300 ft. (1000m) elevation.

Storage/Transport: To 50,000 ft. (15,000m) above Mean Sea Level

Audible Noise Level: 59 dBA measured 4.6 ft. (1.4m) from the surface of the unit

SUBMITTALS

Proposal Submittals: Submittals with the proposal shall include:

Descriptions of equipment to be furnished, including deviations from these specifications.

Document stating compliance with FCC requirements.

Document stating listing to UL, including edition used for listing.

Document showing compliance with required SCCR and labeling.

System configuration with single-line diagrams.

Detailed layouts of customer power and control connections.

Functional relationship of equipment, including weights, dimensions and heat dissipation.

Information to allow distribution system coordination.

Size and weight of shipping units to be handled by contractor.

Order Submittals: Submittals supplied at time of order shall include:

All of the documentation presented with the proposal, per Section 1.5.1 above.

Detailed installation drawings including all terminal locations.

Interconnect wiring diagrams showing conduit wiring with terminal numbers for each wire.

UPS Delivery Submittals: Submittals upon UPS delivery shall include:

A complete set of submittal drawings.

Two (2) sets of instruction manuals. Manuals shall include a functional description of the equipment, safety precautions, instructions, step-by-step operating procedures and routine maintenance guidelines, including illustrations.

WARRANTY

UPS Warranty: The UPS manufacturer shall warrant the unit against defects in workmanship and materials for 12 months after initial startup or 18 months after the shipping date, whichever comes first.

Warranty – End User: Warranties associated with items not manufactured by the UPS supplier but included as part of the system shall be passed through to the end user.

QUALITY ASSURANCE

Manufacturer's Qualifications: A minimum of 20 years' experience in the design, manufacture and testing of solid-state UPS systems shall be required.

The quality system for the engineering and manufacturing facility shall be certified to conform to Quality System Standard ISO 9001 for the design and manufacture of power protection systems for computers and other sensitive electronics.

Factory Testing: Before shipment, the manufacturer shall fully and completely test the UPS unit to ensure compliance with the specification.

The UPS unit shall be tested at the system-specified capacity. Testing shall be done using load banks at part-load and the full kW rating of the unit.

Operational discharge and recharge tests to ensure guaranteed rated performance.

System operations such as startup, shutdown and transfers shall be demonstrated.

A certified copy of the test results shall be available for each system as indicated on the order.

PART 2 - PRODUCT

FABRICATION

Materials: All materials of the UPS shall be new, of current manufacture, high grade and shall not have been in prior service except as required during factory testing. All active electronic devices shall be solid-state. All power semiconductors shall be sealed. Control logic and fuses shall be physically isolated from power train components to ensure operator safety and protection from heat.

UPS Internal Wiring: Wiring practices, materials and coding shall be in accordance with the requirements of the National Electrical Code, OSHA and applicable local codes and standards. All bolted connections of busbars, lugs and cables shall be in accordance with requirements of

the National Electrical Code and other applicable standards. All electrical power connections shall be torqued to the required value and marked with a visual indicator.

Field Wiring:

All field wiring power connections shall be to tin-plated copper busbars for connection integrity. Busbars shall have adequate space to allow two-hole, long-barrel, compression type lugs forming a permanent connection between field wiring and field-installed lugs.

Provisions shall be made in the cabinets to permit installation of input, output and external control cabling using raceway or conduit. Provision shall be made for top and bottom access to input, output, bypass and DC connections. In conformance with the NEC, connection cabinets shall provide for adequate wire bend radius.

Construction and Mounting:

The UPS shall be in NEMA Type 1 enclosures, designed for floor mounting. The UPS shall be structurally adequate and have provisions for hoisting, jacking and forklift handling. Maximum cabinet height shall be 78.7 in. (2000mm).

The UPS shall be NEMA Type 1-compliant, with front doors open to enable safe change of air filters without the need for shutdown.

Cooling:

Adequate ventilation shall be provided to ensure that all components are operated well within temperature ratings.

Temperature sensors shall be provided to monitor the UPS's internal temperature. Upon detection of temperatures in excess of the manufacturer's recommendations, the sensors shall cause audible alarms to be sounded and visual alarms to be displayed on the UPS control panel. Air filters shall be located at the point of air inlet and shall be changeable. No service clearance or ventilation shall be required in the rear of the system.

EQUIPMENT

UPS System: The UPS system shall consist of an IGBT power factor-corrected rectifier, DC-DC converter and three-phase, transformer-free inverter, bypass static transfer switch, bypass synchronizing circuitry, protective devices and accessories as specified. The specified system shall also include a battery disconnect breaker and battery system.

Surge Protection:

The UPS shall have built-in protection against surges, sags and overcurrent from the AC source. The protection shall meet the requirements of ANSI C62.41 A3 and B3 including:

6kV, 100kHz ring wave, line-to-line, line-to-neutral, line-to-ground and neutral-to-ground
6kV, combined wave, line-to-line, line-to-neutral, line-to-ground and neutral-to-ground

Output Protection: The UPS shall be protected against sudden changes in output load and short circuits at the output terminals. The UPS shall have built-in protection against permanent damage to itself and the connected load for all predictable types of malfunctions. Fast-acting, current-limiting devices shall be used to protect against cascading failure of solid-state devices. Internal UPS malfunctions shall cause the module to trip off-line with minimum damage to the module and provide maximum information to maintenance personnel regarding the reason for

tripping off-line. The load shall be automatically transferred to the bypass line uninterrupted for an internal UPS malfunction. The status of protective devices shall be indicated on a graphic display screen on the front of the unit.

COMPONENTS

Rectifier: The term rectifier shall denote the solid-state equipment and controls necessary to convert alternating current to regulated direct current to supply the inverter and charge the battery. The DC output of the rectifier shall meet the input requirements of the inverter without the battery being connected.

Input Current Harmonic Distortion: The rectifier shall actively control and reduce input current distortion over the full operating range of the UPS without the need for an additional passive input filter. Input current THD shall be less than 5% at rated load and nominal voltage in double-conversion mode.

Dynamic Current Input Limit Reduction: The rectifier, in conjunction with the other UPS controls and circuitry, shall adjust the current demanded for battery charging as a function of UPS wattage load and input voltage level.

DC-DC Converter: The term *DC-DC converter* shall denote the equipment and controls to regulate the output of the rectifier to the levels appropriate for charging the battery and to boost the battery voltage to the level required to operate the inverter. The DC-DC converter shall be solid-state, capable of providing rated output power and, for increased performance, shall be a pulse width-modulated design and shall utilize insulated gate bipolar transistors (IGBTs). The DC-DC converter shall control charging of the battery. The AC ripple voltage of the charger DC shall not exceed 1% RMS of the float voltage.

Battery Recharge: In addition to supplying power for the load, the rectifier/charger shall be capable of supplying a minimum of 5% of the module full load power rating for recharging the battery. The battery recharge rate capability shall be sufficient to replace 95% of the battery discharge power within ten (10) times the discharge time while running at 95% of full load at nominal voltage, provided that the battery can accept recharge at that rate. After the battery is recharged, the rectifier/charger shall maintain the battery at full charge until the next emergency operation.

Battery Equalize Charge: A manually initiated equalize charge feature shall be provided to apply an equalize voltage to the battery. The duration of equalize charge time shall be adjustable from 8 to 30 hours. A method shall be available to deactivate this feature for valve regulated battery systems.

Stop Battery Charging Function: Battery charging may be stopped by a shunt trip of the battery cabinet breaker when overtemperature is sensed in the battery cabinet, on generator or when environmental contact is closed.

Overvoltage Protection: There shall be DC overvoltage protection so that if the DC voltage rises to the pre-set limit, the UPS shall shut down automatically and initiate an uninterrupted load transfer to bypass or shall disconnect the battery via the DC breaker(s) in the battery string.

Temperature-Compensated Charging: The UPS shall adjust the battery charging voltage based on the battery temperature reported from external battery temperature sensors. When multiple sensors are used, the voltage shall be based on the average temperature measured. Excessive difference in the temperature measurements shall be reported and the charging voltage adjusted to protect the batteries from excessive current.

Battery Load Testing: The UPS shall be capable of performing battery load testing under operator supervision. To accomplish this, the rectifier shall reduce charging voltage to force the batteries to carry the load for a short time. If the curve of battery voltage drop indicates diminished battery capacity, the UPS shall display an alarm message. If the voltage drop indicates battery failure, the UPS shall terminate the test immediately and annunciate the appropriate alarms.

Inverter: The term *inverter* shall denote the equipment and controls to convert direct current from the rectifier or battery via the DC-DC converter to precise alternating current to power the load. The inverter shall be solid-state, capable of providing rated output power and, for increased performance; the inverter shall be a pulse-width-modulated design and shall utilize insulated gate bipolar transistors (IGBTs). To further enhance reliable performance and efficiency, the inverter shall not require an inverter output series static switch/isolator for the purposes of overload or fault isolation or transfers to bypass.

Overload Capability: The inverter shall be able to withstand an overload across its output terminals while supplying full rated voltage of up to 150% for 60 seconds. The inverter shall be capable of at least 200% current for short-circuit conditions including phase-to-phase, phase-to-ground and three-phase faults. After the fault is removed, the UPS shall return to normal operation without damage. If the short circuit is sustained, the load shall be transferred to the bypass source and the inverter shall disconnect automatically from the critical load bus.

Output Frequency: The inverter shall track the bypass continuously, providing the bypass source maintains a frequency of 60Hz $\pm 1\%$ (0.6 Hz).

Phase-to-Phase Balance: The inverter shall provide a phase-to-phase voltage displacement of no worse than $\pm 3\%$ with a 100% unbalanced load.

Inverter Fault Sensing and Isolation: The UPS shall be provided with a means to detect a malfunctioning inverter and isolate it from the critical load bus to prevent disturbance of the critical load voltage beyond the specified limits.

Battery Protection: The inverter shall be provided with monitoring and control circuits to protect the battery system from damage due to excessive discharge. Inverter shutdown shall be initiated when the battery voltage has reached the end of discharge voltage. The battery end-of-discharge voltage shall be calculated and automatically adjusted for partial load conditions to allow extended operation without damaging the battery. Automatic shutdown based on discharge time shall not be acceptable.

Inverter Bypass Operation: When maintenance is required or when the inverter cannot maintain voltage to the load due to sustained overload or malfunction, a bypass circuit shall be provided to isolate the inverter output from the load and provide a path for power directly from an alternate AC (bypass) source. The UPS control system shall constantly monitor the availability of the inverter bypass circuit to perform a transfer. The inverter bypass circuit shall consist of a continuous duty bypass static switch and an overcurrent protection device to isolate the static bypass switch from the bypass utility source. The bypass static switch shall denote the solid-state device incorporating SCRs (silicon controlled rectifiers) that can automatically and instantaneously connect the alternate AC source to the load.

Static Bypass Switch Rating: The static bypass switch shall be rated for continuous duty operation at full rated load for highest reliability without the use of mechanical devices, such as those used with a momentary rated device.

Manual Load Transfers: A manual load transfer between the inverter output and the alternate AC source shall be initiated from the control panel. Manually initiated transfers shall be make-before-break, utilizing the inverter and the bypass static switch.

Automatic Load Transfers: An automatic load transfer between the inverter output and the alternate AC source shall be initiated if an overload condition is sustained for a period in excess of the inverter output capability or due to a malfunction that would affect the output voltage. Transfers caused by overloads shall initiate an automatic retransfer of the load to the inverter only after the load has returned to a level within the rating of the inverter source and the alarm has been acknowledged.

Momentary Overloads: In the event of a load current inrush or branch load circuit fault in excess of the inverter rating, the bypass static switch shall connect the alternate AC source to the load for at least 600 milliseconds, allowing up to 1000% of the normal rated output current to flow. Output voltage shall be sustained to the extent the alternate AC source capacity permits. If the overload condition is removed before the end of the 600-millisecond period, the bypass static switch shall turn Off and the load shall remain on inverter power. If the overload remains, then a transfer to the alternate AC source is to be completed.

Back-Feed Protection: As required by UL1778 and CSA, the static transfer switch shall not back-feed UPS power to the bypass distribution system while the UPS is operating on battery during a bypass power outage. The purpose of this requirement is to prevent the risk of electrical shock on the distribution system when the normal source of power is disconnected or has failed. If a shorted SCR is detected, the static transfer switch shall be isolated by an internal automatic circuit breaker and an alarm message shall be annunciated at the UPS control panel. The load shall remain on conditioned and protected power after detection of a shorted SCR and isolation of the bypass static switch.

Active ECO-Mode: When selected, this mode of operation shall transfer the load to the bypass source and maintain it there as long as the bypass source frequency, slew rate and voltage are within the adjusted operating parameters. While in this mode, the inverter shall remain operating to be able to instantaneously assume the load without interrupting the output voltage. Should the bypass source go outside the adjusted limits, the bypass static switch shall turn Off, isolating the load from the bypass while the inverter assumes the full critical load. The load shall be transferred from the bypass source to the inverter while maintaining the output voltage within the ITIC and CBEMA curves.

Display and Controls:

UPS Control Panel: The UPS shall be provided with a microprocessor-based control panel for operator interface (may also be referred to as User Interface, or UI) to configure and monitor the UPS. The control panel shall be located on the front of the unit where it can be operated without opening the hinged front door. A backlit, menu-driven, full-graphics, color touchscreen liquid crystal display shall be used to enter setpoints for the battery test (duration and end voltage), display system information, metering information, a one-line diagram of the UPS and battery, active events, event history, startup instructions and transfer and shutdown screens.

No mechanical push buttons shall be used.

Logic: UPS system logic and control programming shall reside in a microprocessor-based control system with nonvolatile flash memory. Rectifier, inverter and system control logic shall utilize high-speed digital signal processors (DSPs). CANbus shall be used to communicate between the logic and the User Interface as well as the options. Switches, contacts and relays shall be used only to signal the logic system as to the status of mechanical devices or to signal user control inputs. Customer external signals shall be isolated from the UPS logic by relays or optical isolation.

Metered Values: A microprocessor shall control the display and memory functions of the monitoring system. All three phases of three-phase parameters shall be displayed simultaneously. All voltage and current parameters shall be monitored using true RMS measurements for accuracy to $\pm 3\%$ of voltage, $\pm 5\%$ AC current. The following parameters shall be displayed:

- Input voltage, line-to-line
- Input current per phase
- Input frequency
- Input apparent power (kVA)
- Battery voltage
- Battery charging/discharging current
- Output voltage, line-to-line
- Output frequency
- Bypass input voltage, line-to-line
- Bypass input frequency
- Load current
- Load real power (kW), total and percentage
- Load apparent power (kVA), total and percentage
- Load percentage of capacity
- Battery temperature, each battery string
- Battery state of charge

Power Flow Indications: A power flow diagram shall graphically depict whether the load is being supplied from the inverter, bypass or battery and shall provide, on the same screen, the status of the following components:

- AC Input Circuit Breaker
- Battery Circuit Breaker, each breaker connection of complete battery complement, complete disconnection and partial connection (one or more, but not all breakers open.)
- Maintenance Bypass Status

Main Display Screen: The following UPS status messages shall be displayed:

- Rectifier (Off / Soft Start / Main Input On / Battery Input On)
- Input Supply (Normal Mode / Battery Mode / All Off)
- Battery Self Test (True / False)
- Input Disconnect (Open / Closed)
- EPO (True / False)
- Charger (On / Off)
- Output Disconnect (Open / Closed)
- Maint. Disconnect (Open / Closed)
- Bypass Disconnect (Open / Closed)
- Inverter (Off / Soft Start / On)
- Bypass (Normal / Unable To Trace / Abnormal)
- Output Supply (All Off / Bypass Mode / Inverter Mode / Output Disable)
- Inverter On (Enable / Disable)

HMI Control Buttons: Buttons shall be provided to start and stop the inverter. A pop-up message requesting confirmation shall be displayed whenever a command is initiated that would change the status of the UPS. Other buttons shall be provided to reset faults and silence the alarm buzzer.

Event Log: This menu item shall display the list of events that have occurred recently while the UPS was in operation. The Event Log shall store up to 2048 events, with the oldest events being overwritten first if the log's capacity is reached.

Battery Status Indicator: A battery status indicator shall display DC alarm conditions, temperature, battery state of charge, the present battery voltage, total discharge time, status of last battery test and battery time remaining during discharge. The UPS shall provide the operator with controls to perform the following functions:

- Configure and manage manual battery test
- Modify test duration and minimum voltage
- Start battery test
- Monitor test status and progression
- Stop battery test
- Battery test status

Alarms: The following alarm messages shall be displayed:

- Mains Voltage Abnormal
- Mains Undervoltage
- Mains Freq. Abnormal
- Charger Fault
- Battery Reversed
- No Battery
- Parallel Comm. Fail
- Bypass Unable To Track
- Bypass Abnormal
- Inverter Asynchronous
- Fan Fault
- Control Power Fail
- Unit Over Load
- System Over Load
- Bypass Phase Reversed
- Transfer Time-Out
- Load Sharing Fault
- Bypass Over Current

Controls: System-level control functions shall be:

- Start Inverter (and transfer to inverter)
- Stop Inverter (after transferring to bypass)
- Startup Screen
- Battery Test Setpoint Adjustment
- Configure Manual Battery Test
- Initiate Manual Battery Test
- System Settings (Time, Date, Language, LCD Brightness, Password, Audio Level)
- Alarm Silence Command
- Fault Reset Command
- ECO mode

Manual Procedures: Load Transfers – HMI buttons (START INVERTER, STOP INVERTER) shall provide the means for the user to transfer the load to bypass and back on UPS.

Self-Diagnostics: Event Log File – The control system shall maintain a log of the event conditions that have occurred during system operation. Each log shall contain the event name, event time/date stamp and a set/clear indicator.

Remote Monitoring and Integration Capabilities: LIFE™ Services: The UPS manufacturer shall provide LIFE services, which provides 24x7 continuous monitoring of events and parametric data, event and data analysis reports and dispatch of factory-trained field service personnel. The UPS shall be able to initiate periodic and critical event-driven communication with a remote service center to transfer event and parametric data for analysis and action. The remote service center shall be staffed with factory-trained service personnel who are capable of receiving, analyzing and interpreting the communicated events and data. The remote service center personnel shall also be capable of dispatching factory-trained field service personnel to the location of the UPS.

Communication Cards: The UPS shall be equipped with three communication card(s) including:

Optional Liebert IntelliSlot™ Unity™ card providing Web-based UPS monitoring and management capabilities, LIFE Services delivery and two of the following third-party open protocols:

SNMP protocols (v1, v2, v3)
Modbus RTU or Modbus TCP
BACnet MSTP or BACnet IP

Note: Modbus RTU and BACnet MSTP cannot both be enabled simultaneously.

Optional Liebert SiteScan® Interface card to interface with Liebert SiteScan Web software.

Liebert IntelliSlot Unity LIFE card included to enable LIFE Services when the optional Liebert IntelliSlot Unity card is not purchased

Output Alarm Contacts: Dry contact outputs shall be provided for Summary Alarm, Bypass Active, Low Battery and AC Input Failure.

Customer Input Contacts: The UPS shall have four discrete input contacts available for the input and display of customer-provided alarm points or to initiate a pre-assigned UPS operation. Each input can be signaled by an isolated, external, normally open contact. When an assembly is selected as a pre-assigned UPS operation, the following actions shall be initiated:

On Generator: Provides selectable choices to enable or disable battery charging and enable or disable ECO Mode operation while on generator.

Transfer to Bypass: Manual command to transfer from inverter operation to static bypass operation.

Fast Power Off: Emergency Module Off (EPO) command to stop UPS operation.

Acknowledge Fault: Acknowledge a UPS alarm condition and present faults will be reset.

Bypass/Inverter Off: Emergency Power Off (EPO) command to stop UPS operation.

External Maintenance Bypass Breaker (MBB) status (open or closed)

Battery Disconnect Breaker: The battery cabinet shall have a properly rated circuit breaker (600VDC) to isolate it from the Liebert eXM UPS. This breaker shall be in a separate NEMA-1

enclosure or in a matching battery cabinet. When this breaker is open, there shall be no battery voltage in the UPS enclosure. The UPS shall be automatically disconnected from the battery by a shunt trip of the battery cabinet breaker when signaled by other control functions.

Battery Plant: The battery plant shall comply with the specifications of:

Matching Battery Power Pack, or
Valve-Regulated, Sealed Cell Battery System on Rack

Matching Battery Power Pack (VRLA Battery): The battery power pack shall consist of sealed, valve-regulated batteries and a properly rated circuit breaker (288VDC nominal, 600VDC maximum) for isolating the battery pack from the UPS. The battery cells and disconnect breaker shall be installed and housed in a NEMA-1 cabinet, matching the UPS style and design.

The battery system shall be sized to support a 60kW load for 10 minutes. The battery system shall provide 100% initial capacity upon delivery.

The battery shall be lead-calcium, sealed, valve-regulated type with a 3-year full warranty and a 7-year pro rata warranty under full float operation. The battery design shall utilize absorbent glass mat (AGM) technology to immobilize the electrolyte.

Flooded-Cell Battery System on Rack: The battery shall be a lead-calcium stationary battery with a 20-year pro rata warranty under full float operation.

Ratings:

Backup time: 10 minutes

Load kW: 60kW

Maximum Specific Gravity: _____

Racks shall be _____-tier, certified for seismic zone _____.

Alloys: Grids shall be manufactured of lead-calcium alloys to ensure long life and consistently low gassing rate over the entire service life; all internal wetted parts shall be of similar non-antimonial alloy to preclude interfacial corrosion at the bonded area. Plates

Both positive and negative plates shall be of the flat pasted plate design to ensure highly reliable electrical performance throughout the life of the battery. Positive plates shall be at least 0.16 in. (0.4cm) thick. Physical support of the positive plate group shall be via a suspension system that allows for normal plate expansion without stressing the jar or cover.

Terminals: All batteries larger than 1.5 kW/cell (15-minute rate to 1.67 volts per cell) shall include copper inserted terminal posts allowing connector torque of 160 pound inches and copper-to-copper interface with the intercell connector (except for flashing). Terminal posts shall be of sufficient strength to support normal inter-tier or inter-step cabling without additional bracing.

Container: The cell cover shall be of a flame-retardant material with an oxygen index of at least 28; all jars shall be transparent to allow visual inspection of the plates and sediment spaces. Cell covers shall include provision for sampling of the electrolyte below the tops of the plates.

Intercell Connections: For each bolted connection, lead-plated copper connectors and corrosion-resistant bolts shall be provided; interconnecting hardware shall be sized so as to permit discharge at the maximum published rate while allowing no more than 30 mV of voltage drop between adjacent units at the one-minute rate to 1.75 volts per cell (VPC). Along with the

necessary hardware, the supplier shall furnish NO-OX-ID grease to coat the contact area of all electrical connections.

Racks: Racks shall have welded steel support frames and unitized rail construction to prevent long-term warpage and resultant stresses on the cells and interconnections. All metallic rack components that directly contact the battery shall be insulated by removable covers.

Packaging: The battery jar design shall allow lifting straps to be inserted beneath the cells without moving, lifting or tilting the cells. Packaging shall ensure that plates are perpendicular to the normal direction of travel during transportation.

Provide a flush-mounted remote alarm annunciator with audible alarm. This display shall be touchscreen type HMI UPS interface to display UPS duplicate screen.

Manufacturing Controls: Each cell shall be clearly identified as to cell type, voltage and capacity as well as manufacturing control group for future quality assurance traceability. All cells in the battery shall be tested to verify 100% system capacity. The equipment shall be designed and manufactured under a quality assurance program that is controlled and documented by written policies, procedures or instructions and which shall be carried out throughout the performance of the work. The quality assurance program shall conform to the requirements of ANSI N45.2, MIL I-45208A and MIL-Q-9858.

Accessories and Features:

Load Bus Sync: The Load Bus Sync (LBS) shall enable two independent single-module UPS units to stay in sync when operating on battery or unsynchronized input sources. The LBS shall determine the master and slave relationship between UPS units. The LBS shall be installed within each single-module UPS.

Communication Card: A communication card shall provide Web-based UPS monitoring and management capabilities and one or two of the following remote monitoring protocols: SNMP (v1, v2, v3), Modbus or BACnet for remote monitoring.

Relay Contact Card: A relay contact card shall provide output dry contact signals communicating the following UPS states: Summary Alarm, Bypass Active (On Bypass), Low Battery, AC Input Failure (UPS Fault) and On UPS.

Liebert SiteScan® Communication Card: The Liebert SiteScan communication card shall provide a connection to a Liebert SiteLink-E™, allowing Liebert SiteScan Web to monitor and control the UPS.

Seismic Anchorage Kits: Seismic anchorage kits shall be provided with the UPS unit, and if included the optional matching battery cabinet, for use in seismic restraint as required for IBC 2012 or OSHPD certification.

PART 3 - EXECUTION

Field Quality Control: The following inspections and test procedures shall be performed by factory-trained field service personnel during the UPS startup.

Visual Inspection:

Inspect equipment for signs of damage.

Verify installation per drawings supplied with installation manuals or submittal package.

Inspect cabinets for foreign objects.

Verify that neutral and ground conductors are properly sized and configured per Emerson Network Power® requirements as noted in Emerson drawings supplied with installation manuals or submittal package.

Inspect each battery jar for proper polarity.

Verify that all printed circuit boards are configured properly.

Mechanical Inspection:

Check all control wiring connections for tightness.

Check all power wiring connections for tightness.

Check all terminal screws, nuts and/or spade lugs for tightness.

Electrical Inspection:

Check all fuses for continuity.

Confirm input and bypass voltage and phase rotation are correct.

Verify control transformer connections are correct for voltages being used.

Ensure connection and voltage of the battery string(s).

UNIT STARTUP

Energize control power.

Perform control/logic checks and adjust to meet Emerson specification.

Verify DC float and equalize voltage levels.

Verify DC voltage clamp and overvoltage shutdown levels.

Verify battery discharge, low battery warning and low battery shutdown levels.

Verify fuse monitor alarms and system shutdown.

Verify inverter voltages and regulation circuits.

Verify inverter/bypass sync circuits and set overlap time.

Perform manual transfers and returns.

Simulate utility outage at no load.

Verify proper recharge.

MANUFACTURER'S FIELD SERVICE

Service Personnel: The UPS manufacturer shall directly employ a nationwide service organization, consisting of factory-trained field service personnel dedicated to the startup and maintenance of UPS and power equipment.

The manufacturer shall provide a national dispatch center to coordinate field service personnel schedules. One toll-free number shall reach a qualified support person 24 hours a day, 7 days a week and 365 days a year. If emergency service is required, on-site response time shall be 4 hours or less within 150 miles of an Emerson Network Power® Liebert® Services center.

Two local customer engineers shall be assigned to the site with a regional office as a backup. Escalation procedures shall be in place to notify Power Technical Support if a site is not functioning within 24 hours.

Automated Site Monitoring: The UPS manufacturer shall provide an automated site monitoring service. This service shall be staffed by a qualified support person 24 hours a day, 7 days a week and 365 days a year. At the detection of an alarm within the UPS, the controls shall initiate communication with the monitoring service. The monitoring service shall be capable of interpreting the communicated alarms to allow dispatch of a service engineer.

Replacement Parts Stocking: Parts shall be available through an extensive network to ensure round-the-clock parts availability throughout the country.

Spare parts shall be stocked by local field service personnel with backup available from national parts centers and the manufacturing location. A Customer Support Parts Coordinator shall be on call 24 hours a day, 7 days a week, 365 days a year for immediate parts availability.

Maintenance Contracts: A complete offering of preventive and full-service maintenance contracts for both the UPS system and battery system shall be available.

END OF SECTION 263353

SECTION 263613 – DIESEL GENERATOR SET

PART 1 – GENERAL

SUMMARY:

Extent of diesel generator set work is indicated by this specification, associated attachments and is hereby defined to include, but is not limited to, diesel engine, unit mounted radiator, electrical generator, engine starting system including batteries, UPS compatible governor, charger, jacket heater, instrument control panel, annunciator panel, exhaust silencer, weatherproof enclosure hardened for Florida Building Code missile impact rated and wind rating for Franklin County, Florida (150mph), unless otherwise noted in the plans, digital regulator, double wall UL 142 base type diesel fuel tank, start/stop break glass station, generator main (emergency / life safety) circuit breaker (mounted inside generator enclosure) & standby power circuit breaker listed (mounted inside generator enclosure), associated normal / emergency lighting around generator (enclosure mounted or as indicated in plans) and illuminating generator controls / breakers, and accessories for a complete factory tested and operational generator. Provide Veeder-Root type leak detection system including remote panel, all required probes (interstitial space, tank level), all alarms and related items. See separate "DIESEL FUEL LEAK AND LEVEL ELECTRONIC MONITORING SYSTEM" specification. (Note the maximum dimensions for the generator enclosure shall not exceed the available space indicated on plans (see below for the fuel tank footprint also). Contractor shall obtain the actual manufacturer dimensions and all related data (including generator conduit stub up locations, etc.) prior to ordering the generator set or related items, and shall verify compatibility with all available accommodations per applicable architectural and engineering plans. Provide basis of design generator (Caterpillar). Refer also to separate "Electrical Commissioning" specification (if applicable).

Type of generator set required for this project include the following:

- Low emissions compliant with Federal emissions for diesel engine driven generators
- Units supplied shall meet all NFPA Level 1 requirements.
- Units shall include a U.P.S. compatible governor and digital regulator.

SUBMITTALS:

General:

Submit 6 sets of all submittal data in 3 ring binders with indexed and tabbed sections. Include project title sheet.

Product Data: Submit manufacturer's data on the diesel engine driven generator set and components. Include manufacturer's standard product warranty, for duration of not less than five years, comprehensive parts, labor and travel for replacement of materials and equipment used in diesel generator systems.

Shop Drawings: Submit layout drawings of diesel engine driven generator units and accessories including, but not limited to, fuel line piping, remote start/stop stations, and instrumentation. Show generator set required service and operational clearances. Provide operation and maintenance manuals.

Wiring Diagrams: Submit wiring diagrams for the diesel engine driven generator unit showing connections to electrical power panels, feeders, automatic transfer switches, and ancillary equipment. Differentiate between portions of wiring that are manufacturer- installed and portions that are field installed.

Agreement to Maintain: Prior to time of final acceptance, submit 6 copies of an agreement for continued service and maintenance of diesel engine driven generator set, for Owner's possible acceptance. Offer terms and conditions for furnishing parts and providing continued testing and servicing, including replacement of materials and equipment, for five-year period with option for renewal of Agreement by Owner.

Certifications: Provide diesel engine driven generator set factory certified test record of the following final production testing:

- Single step load pickup.
- Transient and steady state governing.
- Safety shutdown device testing.
- Voltage regulation.
- Rated power.
- Maximum power.

QUALITY ASSURANCE:

Manufacturer's Qualifications: Firms regularly engaged in manufacture of diesel engine driven generator units and ancillary equipment, of types, ratings and characteristics required, whose products have been in satisfactory use in similar service for not less than 5 years.

Codes and Standards:

Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and (2011) NEC Articles 700, 701, and 702 pertaining to construction and installation of emergency and standby systems.

NFPA Compliance: Comply with applicable requirements of NFPA 30, Flammable and Combustible Liquids, NFPA 37,(2010), "Installation and Use of Stationary Combustion Engines and Gas Turbines and NFPA 110, (2010), "Standard for Emergency and Standby Power Systems".

UL Compliance: Comply with applicable requirements of UL 1008, "Automatic Transfer Switches," UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors," and UL 486B, "Wire Connectors for Use with Aluminum Conductors." UL 2200, "Stationary Generator Engine Assemblies", UL 2085, "Steel Aboveground Tanks for Flammable and Combustible Liquids".

ANSI/NEMA Compliance: Comply with applicable requirements of ANSI/NEMA MG 1, "Motors and Generators," and MG 2, "Safety and Use of Electric Motors and Generators."

NEMA Compliance: Comply with applicable requirements of NEMA's Stds Pub No. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."

IEEE Compliance: Comply with applicable portions of IEEE Std 446, "IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications."

DELIVERY AND HANDLING:

Deliver the diesel engine driven generator properly packaged and mounted on pallets, or skids to facilitate handling of heavy items. Utilize factory fabricated type containers or wrappings for engine generator and components which protect equipment from damage.

Store diesel engine driven generator equipment in original packaging and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.

Handle diesel engine driven generator equipment carefully to prevent physical damage to equipment and components. Do not install damaged equipment; remove from site and replace damaged equipment with new. Off-loading and placement of generator and double wall base fuel tank on a slab is not included in this contract.

Provide lifting points and attachment hardware for all equipment.

WARRANTY

Provide a 5-year complete parts and labor warranty. Warranty period shall start at project substantial completion.

PART 2 – PRODUCTS

MANUFACTURERS

Manufacturer: Subject to compliance with all requirements, provide diesel generator set from the following:

Cummins
Caterpillar

General: Except as otherwise indicated, provide manufacturer's standard diesel engine-driven generator set and auxiliary equipment as indicated by published product information, and as required for a complete installation.

Diesel Engine Driven Generator: Provide one packaged electrical power diesel engine driven generator, assembly unit 150kw, 187.5kva, rated at a governed speed of 1800 RPM, and rated 80 percent power factor for prime-rated operation, 120/208, 3 phase, 4 wire, 60 Hz, at 500 feet altitude, at 104 deg F (40 deg C). Equip generator with four cycle, 1800 RPM, turbo charged diesel engine, and fueled with No. 2 diesel; liquid cooled. Provide unit mounted radiator, blower fan, water pump, thermostat, and radiator duct flange capable of cooling engine with up to 0.5 inches water static pressure on fan. Connect engine drive directly to a 4 pole revolving field type single, maintenance free bearing generator through a semi-flexible steel disk coupling. Equip set with associated controls to interface with automatic transfer switch equipment to automatically start engine, transfer load to emergency power within 10 seconds upon failure of normal power source, transfer load back to normal power upon its restoration, and stop engine. Cushion mount engine generator on heavy steel base with vibration isolators to reduce possibility of torsional vibration. Provide water cooled type engine with unit mounted radiator. Equip engine with low oil pressure, high water temperature, and automatic over speed safety shutdown devices. Equip generator with exciter and digital (DVR) voltage regulator to maintain voltage within 2 percent of rated value. Direct connect generator to fly wheel by semi-flexible steel disk coupling. Provide unit capable of voltage recovery, within regulated range, of 7 seconds following sudden load increase from 0 to 100 percent of rated load, and with voltage dip not to exceed 20 percent upon application of rated load at rated power factor. Provide 2/3 pitch winding configuration. Construct unit in compliance with applicable standards; and with additional construction features as indicated. Provide vibration control and isolation for diesel engine driven generator units including pads, springs, rails, bases, hangers, control and isolation.

Generator shall maintain current level 300% above rating for a minimum of 10 seconds to allow time for coordination of overcurrent devices. Series boost on the regulator circuit or a permanent magnet exciter shall be provided to satisfy this requirement.

Generator Circuit Breakers. Provide engine-generator unit with one (1) unit mounted 100% rated, 3 pole circuit breakers, and with voltage rating of 600 VAC, 65k AIC (or exceeding 200% of the absolute worst case fault current of the generator). Breaker shall be electronic adjustable type with LSI trip unit (adjustable Long Time trip, Long delay, Short Time Trip, Short delay, and Instantaneous

trip setting). Basis of Design is Square D NW series with Micrologic trip unit incorporating the required LSI adjustable settings. Long Time Trip settings shall be as noted on the electrical plans. Further, Long Time selection must permit setting down to 0.40 rating plug value). Generator main breaker rating plug shall be 600A. Include circuit breaker data, including trip curves, with submittals. Provide all required lugs and any adapter items as needed to accommodate the number and size of conductors for the feeder from the generator to the facility, as indicated on the electrical drawings. Comply with NEC 445.13 (ampacity 115% of generator full load current rating) for the conductors or bus bars which connect from the generator / alternator output terminals to the input side of the generator breaker(s). Long time setting for standby power circuit breaker shall be 500 Amps; or as specified by the engineer; other breaker settings per engineer.

Starting System: Provide engine generator unit with 24 volt, 2 or 3 wire, negative ground, starting system including 24-volt positive engagement solenoid shift starting motor, batteries and 10 ampere, or greater, automatic battery charging alternator with solid state voltage regulation. Batteries shall be high output type with high cold crank ampacity and reserve capacity. Battery construction shall consist of polypropylene case and low antimony lead acid sealed type design. Provide 5-year warranty.

Instrument Control Panel: Provide engine generator unit with engine oil pressure and water temperature indicators, battery charge rate ammeter, START - STOP switch for manual operation of unit, reset circuit breaker, static voltage regulator, voltage adjusting rheostat, voltmeter, ammeter with phase selector switch with an OFF position, and with running time indicator and frequency meters. Select type circuitry of plug-in design capable of quick replacement, and of accepting a plug-in device which allows maintenance to test control panel performance without operating the engine. Provide engine/generator electronic resettable exerciser.

Provide engine block heater, of wattage and voltage to match electrical circuit (see electrical plans, riser diagram and panel schedules), with thermostatic controls to maintain engine coolant at proper temperature to fulfill start-up requirements of NFPA.

Provide NFPA 110 compliant 16 light annunciator panel with visual and audible alarms to monitor and warn of emergency operating conditions affecting line and generator power sources.

Provide insulated critical location sound rated exhaust silencer with drain, piping, exit thimble and flapper cap, with a 25dBA Attenuation measured at 23'-0". Exhaust system shall be equipped with hardware required to direct exhaust away from building (see drawings). The exhaust silencer, piping, and fitting shall be manufactured of 304 stainless steel.

Provide all required components, wiring and logic required to monitor generator output for ground fault conditions. This signal shall be transmitted to generator set control panel and annunciator.

Provide emergency generator break glass control station, Emergency Power Off (EPO) pushbutton.

Provide battery chargers & starting batteries, and battery heater to match circuits (see electrical plans riser diagram and panel schedules).

Provide weatherproof NFPA 101 compliant battery backup emergency lighting to illuminate all control panels / breakers inside the generator, and to illuminate the area around the generator (see electrical plans). Lighting shall provide for automatic activation upon loss of AC line power (sensing of 'unswitched' phase conductor) via battery backup, but shall also provide for manual switching of this lighting when line power is present.

Provide double wall diesel fuel tank, with diesel fuel capacity required for 72 (seventy-two) hours (72 hours shall be 7/8th of total tank capacity) of continuous operation of the generator at full load (generator 100% load). The tank footprint shall not exceed dimensions indicated on plans, and must be compatible with the concrete pad and all accommodations (see electrical/structural sheets for

further details). The tank shall be listed and labeled as a "special purpose, protected UL 142 secondary containment diesel fuel tank". The tank shall have interstitial space monitoring fittings and also have a minimum 7.5-gallon fuel containment type stainless steel filler spout. The tank shall be encapsulated on the outside with a rust/corrosion standard manufacturer colored polyester glass flake 15 mils thick coating and then finished with a standard manufacturer aliphatic polyurethane 5 mils coating. The tank shall be mounted on I beam support rails that will provide a minimum of 6" clearance below the bottom of the tank and the slab it's mounted on. The tank shall have earthquake/hurricane tie downs. The inner tank shall be sloped to a drain fitting that's accessible from the outside. Tank outlets shall be 304 Schedule 40 Stainless Steel. The primary and secondary tanks shall be constructed from minimum ¼" steel and shall meet all UL 142 requirements. Emergency venting shall be provided. The maximum height of the tank shall be no greater than necessary given the length and width constraints of the generator footprint per the plans. If top of tank is 21" or higher above slab, provide platform(s). The platform, or other means for attaining access, shall include safety rails and aluminum "ship" ladder(s) or other means (as needed) for accessing the top of tank and interior of the enclosure housing. Such means may be portable, but shall be adequate for accessing all required generator controls and equipment from the exterior of the generator enclosure. Or, other means may be provided (attached to generator enclosure / tank) as long as such access means fit within the indicated generator compound space, and all OSHA and other safety requirements are met to permit safe access and working space for all generator controls and other components requiring service or inspection. Provide full submittal for platform. The tank shall have a 30-year warranty that includes the primary and secondary tanks. The tank shall be designed, labeled and tested per UL requirements. The tank(s) shall be in complete compliance with all applicable Florida Department of Environmental Protection (DEP) Agency requirements and guidelines and approved list for fuel tanks. Verification of the applicable requirements based upon tank size for 72 hours operation (72 hours shall be 7/8th of total tank capacity) at (generator) load defined above, and coordination with the DEP is the responsibility of the installing site Electrical Contractor. Tank shall include all required ports, and fittings, to accommodate the required fuel monitoring probes and interstitial space probes listed below.

Provide weatherproof enclosure with locking doors. Provide with updraft discharge.

Exhaust shall be directed away from building(s), and shall include spark arrester.

Provide interstitial space monitoring probe(s)/sensor(s) for the above tank. Include the following and all other components per State of Florida administrative code chapter 62-761 (with latest revisions) requirements:

1. Primary and secondary tank containment.
2. Spill containment at each tank fill connection.
3. Provisions for electronic monitoring of interstitial space (may connect to generator annunciator).
4. Fuel level gauge (manual)
5. Anti-siphon and automatic shutoff valves.
6. Float switches (High level, Low level, etc.). These may connect to generator annunciator.
7. Valves. *Note: Ensure also that a suitable suction side fuel line check valve is provided as required to guarantee that fuel flow / supply to generator is maintained at all times as appropriate.*

Means for detecting and alarming (audio / visual) an overfill condition both AT the generator, and at the location of the generator annunciator, shall be provided. For the alarm means at the generator, mount the device so it is visible from the refueling port of the generator tank.

PART 3 – EXECUTION

INSTALLATION OF DIESEL ENGINE DRIVEN GENERATOR SETS

Manufacture, shipping, insuring, weatherproofing, and delivery is part of this contract. Comply with NFPA and NEMA standards pertaining to engine generator sets and accessories.

FIELD QUALITY CONTROL

Start-up Testing:

Provide equipment manufacturer's representative to perform start-up, load bank and building load tests upon completion of installation, provide certified test record. Tests are to include the following:

Check fuel, lubricating oil, and antifreeze in liquid cooled models for conformity to the manufacturer's recommendations under environmental conditions present.

Test prior to cranking engine for proper operation, accessories that normally function while the set is in a standby mode. Accessories include: engine heaters, battery charger, generator strip heater, remote annunciator.

Check, during start-up test mode, for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and standby line-to-line voltage and phase rotation.

Test, by means of simulated power outage, automatic start-up by remote automatic starting, transfer of load, and automatic shut-down. Prior to this test adjust, for proper system coordination, transfer switch timers. Monitor throughout the test, engine temperature, oil pressure, battery charge level, generator voltage, amperes, and frequency. This shall also include a four (4) hour 80% PF full load on site reactive load bank test. Provide all lubricants, fuel and antifreeze for test & top off after completion.

Upon completion of installation demonstrate capability and compliance of system with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting. Initial testing and retesting to be at no additional cost to Owner. Submit report to Owner.

PERSONNEL TRAINING

Operating Personnel Training: Train Owner's personnel in procedures for starting up, testing and operating diesel engine driven generator sets. Provide eight (8) hours of onsite training. In addition, train Owner's personnel in periodic maintenance of batteries. Submit report to Owner.

Equipment Manuals: Provide six (6) bound sets of all cut sheet information, warranties and service agreements. This data shall include wiring diagrams, equipment technical information, operation, and service recommendations.

END OF SECTION 263613

SECTION 263613B - DIESEL FUEL LEAK AND LEVEL ELECTRONIC MONITORING SYSTEM

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

SUMMARY

All work associated shall be performed by a licensed storage tank contractor.

This Section includes basic description of continuous tank-gauging/leak-detection monitoring and reporting system. The system is to include continuous monitoring and reporting for each of the above-ground fuel storage tanks, (main) and any fuel piping and dispensing sumps as applicable. Reporting module is to be located inside the Electrical room. Remote monitoring shall be provided. Remote monitoring equipment shall be located at facilities 24-hour monitoring location.

SYSTEM PERFORMANCE REQUIREMENTS

System is to satisfy all federal, state and local codes and requirements for monitoring above-ground combustible fuel storage tanks and dispensers.

SUBMITTALS

Submit manufacturer's data for system, probes, controller and reporting modules.

Provide confirmation indicating conduit, tank flanges and space provided in plans will accommodate system to be installed.

MANUFACTURERS

Provide system of probes, sensors, annunciator and reporting modules are of the same manufacturer. Approved manufacturer:

Veeder-Root (basis of design TLS-450 Plus) with printer.

EQUIPMENT

Provide probes and sensors for: monitoring and reporting product level and overfill in each of the above-ground fuel storage tanks illustrated in the drawings.

Provide probes, all conduit/wiring, and sensors for monitoring and reporting leaks (leak-detection) in secondary containment (interstitial) spaces of each of the above-ground fuel storage tanks, (main tank) illustrated in applicable drawings.

Provide probes and sensors for monitoring and reporting of leaks (leak detection) and power shutdown upon detection in each of the fuel lines and sumps.

Provide external annunciation with audible and visual alarm for leak detection and storage tank overfill conditions.

Provide means in the form of telephone (voice) connection for contacting an authorized fuel provider when fuel level reaches predetermined threshold. Unit should perform this function as an automated feature.

Provide system controller, remote reporting module and software for complete, functioning reporting system as indicated. Input capability must be equal to or greater than functions indicated. System to accommodate distance between controller/ reporting module and probes/sensors as illustrated on drawings without modifications or malfunctions. System to accommodate temperature fluctuations of above-ground storage tanks without modifications or malfunctions.

REPORTING

Reporting to include LED display, printed chart, annunciator output and RS-232 serial communications interface (or if distance is an issue, and if equipment to be interfaced is compatible, RS-485 communications interface). Reporting to include:

- Inventory information
- Leak detection
- Sensor data
- Delivery data
- Alarm history
- System configuration
- Tank status (fuel level with low and high alarms)
- Fuel management

Reporting format capable thru interface with 80-column wide serial printer.

INSTALLATION

To be completed by factory-trained technicians. include all cables, connections and fittings for a complete operating system.

DEMONSTRATION

Train Owner's personnel on procedures, schedules and operation of system. Successfully demonstrate all system reporting outputs.

END OF SECTION 263613B

SECTION 263623 - TRANSFER SWITCHES

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

SUMMARY

This Section includes transfer switches rated 600V and less. It includes the following items:

Automatic Transfer Switch (ATS).

Related Sections: The following Sections contain requirements that relate to this Section:

Conductors for hard-wired connections between transfer switches and remote equipment are specified in Division 26 Section "Wires and Cables".

SUBMITTALS

General: Submit the following according to Conditions of Contract Specification Section.

Shop drawings or published product data for each transfer switch, including dimensioned plans, sections, and elevations showing minimum clearances; conductor entry provisions; gutter space; installed features and devices; and materials lists.

Wiring diagrams, elementary or schematic, differentiates between manufacturer-installed and field-installed wiring.

Single-line diagrams of transfer switch units showing connections between automatic transfer switch, bypass/isolation switch, power source, and load, plus interlocking provisions.

Operation and maintenance data for each type of product, for inclusion in Operating and Maintenance Manual specified in Division 01. Include all features and operating sequences, both automatic and manual. List all factory settings of relays and provide relay setting and calibration instructions.

Manufacturer's certificate of compliance to the referenced standards and tested short-circuit closing and withstand ratings applicable to the protective devices and current ratings used in this Project, as indicated and as specified in paragraph "Tested Fault Current Ratings."

QUALITY ASSURANCE

Manufacturer's Qualifications: Firms are experienced in manufacturing equipment of the types and capacities indicated and have a record of successful in-service performance.

Emergency Service: Manufacturer maintains a service center capable of providing emergency maintenance and repairs at the Project site with an 8-hour maximum response time.

Comply with NFPA 70, "National Electrical Code," for components and installation.

Comply with NEMA ICS 1, "General Standards for Industrial Control," ICS 2, "Industrial Control Devices, Controllers and Assemblies," and ICS 6, "Enclosures for Industrial Controls and Systems."

UL Listing and Labeling: Items furnished under this Section are listed and labeled by UL for emergency service under UL Standard 1008.

Nationally Recognized Testing Laboratory Listing (NRTL) and Labeling: Items furnished under this Section are listed and labeled by a NRTL for emergency service under UL Standard 1008.

Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.

Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

UL Compliance: Comply with UL Standard 1008, "Automatic Transfer Switches," except where requirements of these Specifications are stricter.

PART 2 - PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by the following:

Automatic Switch Co. (ASCO) 4000 series (no bypass isolation).
#ATSB3400N5XC-14A/14B 600A 4P.

TRANSFER SWITCH PRODUCTS, GENERAL

Number of Poles and Current and Voltage Ratings: As indicated.

Units 600 amperes and smaller have current ratings that apply to mixtures of loads including 30% maximum tungsten filament lamp load.

Tested Fault-Current Ratings: Closing and withstand ratings exceed the indicated available RMS symmetrical fault current at the equipment terminals based on testing according to UL Standard 1008, conducted at full-rated system voltage and 20% power factor. Rate each product for withstand duration time as follows when tested for rated short-circuit current correlated with the actual type of circuit protective device indicated for transfer switches for this project:

100 Amperes or Larger: 1.5 closing and withstand duration cycles.

Current-Limiting Fuses: 0.5 (nominal) closing and withstand duration cycles.

Annunciation and Control Interface Components: Devices at transfer switches for communicating with remote enunciators or enunciator/control panels have communications capability matched with the remote device.

Solid-State Controls: Repetitive accuracy of all settings is plus or minus 2% or better over an operating temperature range of minus 20°C to 70°C.

Resistance to Damage by Voltage Transients: Components meet or exceed voltage surge withstand capability requirements when tested according to ANSI C37.90.1, IEEE Guide for Surge Withstand Capability (SWC) Tests. Components meet or exceed voltage impulse withstand test of NEMA ICS 1.

Enclosures: NEMA 1, conforming to UL Standard 508, "Electric Industrial Control Equipment," except as otherwise indicated.

Factory Wiring: Train and bundle factory wiring and identify consistently with shop drawings, either by color code or by numbered or lettered wire and cable tape markers at terminations.

Designated terminals accommodate field wiring.

Power Terminals Arrangement and Field Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.

Terminals: Pressure-type, suitable for copper or aluminum conductors of sizes indicated.

Control Wiring: Equipped with lugs suitable for connection to terminal strips.

Electrical Operation: Where indicated, accomplish by a non-fused, momentarily energized solenoid or electric motor-operated mechanism, mechanically and electrically interlocked in both directions. Switches using components of molded-case circuit breakers or contactors not designed for continuous-duty, repetitive switching between active power sources is not acceptable.

Switch Action: Mechanically held in both directions for double-throw switches.

Switch Contacts: Use silver composition for switching load current. Units rated 225 amperes and more have separate arcing contacts.

Overcurrent devices are not part of switch products.

AUTOMATIC TRANSFER SWITCHES (ATSs)

Comply with Level 1 equipment according to NFPA 110, "Standard for Emergency and Standby Power Systems."

Switching Arrangement: 3-phase, 4-pole, 4-wire double-throw type, incapable of pauses or intermediate position stops during normal functioning except as indicated.

Manual Switch Operation: Manually operated under load with the door closed with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

Signal-Before-Transfer Contacts ("PRE-TRANSFER" Contact Option): 2 sets of normally open/normally closed dry contacts to operate in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds; equivalent to ASCO option 18Z for 4000 series ATS.

Signal-After-Transfer Contacts ("POST-TRANSFER" Contact Option): 2 sets of normally open/normally closed dry contacts to operate in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

ATS "state" contacts: 2 sets of normally open / normally closed dry contacts indicating "normal" or "emergency".

ATS shall have an electronic circuit monitor, see applicable specification section.

AUTOMATIC TRANSFER SWITCH FEATURES

Voltage sensing for each phase of normal source; pick-up voltage is adjustable from 85% to 100% nominal and dropout voltage is adjustable from 75% to 98% pick-up value. Factory set for pick-up at 90% and drop-out at 85%.

Time-delay override of normal source voltage-sensing delays transfer and engine start signals. Adjustable 0 to 6 seconds, and factory set at 1 second.

Voltage/Frequency Lockout Relay: Prevent premature transfer. Voltage pick-up is adjustable from 85% to 100% nominal. Factory set to pick-up at 90%. Pick-up frequency is adjustable from 90% to 100% nominal. Factory set to pick-up at 95%.

Retransfer Time Delay: Adjustable from 0 to 30 minutes and factory set at 10 minutes. Provides automatic defeat of the delay upon loss of voltage or sustained under voltage of the emergency source, provided the normal supply has been restored.

Test Switch: Simulates normal source failure.

In-phase Monitoring: An In-phase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The in-phase monitor shall be specifically designed for and be the product of the ATS manufacturer. The in-phase monitor shall be equal to ASCO Feature 27.

Switch-Position Pilot Lights: Indicate source to which the load is connected.

Source-Available Indicating Lights: Supervise sources via the transfer switch normal and emergency source-sensing circuits.

Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

Unassigned Auxiliary Contacts: Two normally open SPDT contacts for each switch position.

Rating: 10 amperes at 240V a.c.

Transfer Override Switch: This switch can be set to override automatic retransfer control so the ATS will remain connected to the emergency power source regardless of the condition of the normal source. A pilot light indicates the override status.

Engine Starting Contacts: One isolated normally closed and 1 isolated normally opened. Contacts are gold flashed or gold plated and rated 10 amperes at 32V d.c. minimum.

Engine Shut-Down Contacts: Time delay adjustable from 0 to 5 minutes; factory set at 5 minutes.

Provide the following additional features.

Source available contacts.

Pre-transfer contacts.

Remote monitoring and control (see "Remote Monitoring and Control" section below).

Power manager (see "Remote Monitoring and Control" section below).

NEMA 1 enclosure.

100,000 A.I.C. rating, or as indicated on drawings.

Post-transfer contacts.

ATS state contacts (normal power / emergency power indication).

Engine-Generator Exerciser: Solid-state programmable time switch starts engine-generator set and transfers load to it from normal source for a preset time, then retransfers and shuts down engine

after a preset cool-down period. Initiate exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory-set periods are for 7 days and 20 minutes, respectively.

Exerciser features include:

Exerciser transfer selector switch, which permits selection between exercise with and without load transfer.

Push button programming controls with digital display of settings.

Integral battery operation of time switch when normal control power is not available.

In phase monitor to assure closing of contacts when load and source being transferred to are within acceptable phase angle. Provide ASCO 100% switched neutral pole (neutral transfer contact option = conventional neutral contacts).

Automatic transfer switch shall be Automatic Switch Company (ASCO), Series 4000, or approved equal.

Remote Monitoring and Control: Each ATS shall be equipped with necessary accessory items required to provide remote monitoring and control. A remotely located user / personal computer (PC) (this PC is not furnished as part of this project) can contact the ATS and monitor various parameters including, but not limited to normal and emergency (generator) voltage, current, power, kilowatt hours, generator status information, and certain user defined information (specifically a connection from fuel monitoring equipment indicating 24 hours of fuel remaining), in addition to controlling certain functions (see "Network Communication and Management" below). It should also be possible for the remote site ATS to contact the remotely located user / personal computer. This is accomplished using a network connection within the facility, with certain ATS options provided to accommodate this (see below).

Special software available from the manufacturer of the ATS must be installed on the remote PC (this software is part of the scope of this project) and is required for the remote monitoring and control functions. ASCO provides this through their "Powerquest™" software package.

Accessory components required to provide the remote monitoring and control capability shall be internal to the ATS (manufacturer provided and installed). At least one ATS (the "contact ATS") shall provide the means for establishing the connection (see "Communication Interface" below). If the location includes more than one ATS, the contact ATS shall interface with each additional ATS using an RS 485 connection, or approved equal. Each ATS shall include means for establishing this RS 485 link (or approved equal) such that the contact ATS can receive status information from every ATS at the site associated with the generator(s) installed per this project (see "Communications Interface" below).

Each ATS shall be equipped with an accessory called a "power manager" (see "Power Monitoring" below). This provides the means for power measurements which are fed to the remote PC.

Communications Interface: ATS's shall be furnished with a Serial Communication Module, which shall be capable of direct connect or multi-drop configured network communication. The module shall allow for the seamless integration of existing or new communication modules. The module shall have two port connectors used for ATS & stand alone Power Manager connectivity. The serial communication interface shall be equal to ASCO Accessory 72A.

Power Monitoring: ATS's shall be supplied with a power metering device which provides real-time measurement of single and three phase power. The Power Manager shall use digital signal processing technology to measure voltage and current per phase, real, reactive and apparent power, and bi-directional energy. All measurements shall be viewed

locally with a backlit liquid crystal display and or displayed remotely via an internet browser based network management system. The Power metering device shall be equal to ASCO Accessory 85L.

Network Communication and Management: A network communication, management and control system shall be supplied with remote monitoring and control capability. The Industrial PC based system shall generate HTML pages that provide simple, easy to understand web pages utilizing information that it gathers from system ATS's and Power Managers. The system shall be capable of remote control functions including ATS transfer and retransfer, bypass time delays and ATS identification. The system shall monitor up to 32 power transfer switches. The system shall allow connection to remote ATS's via a telephone interface module for direct dial up, monitoring and control of remote locations. The remote monitoring and control system shall be equal to the ASCO PowerQuest™.

Note: The manufacturer / factory installed accessory item part numbers identified above may be available as a complete option set identified by a special accessory part number – consult manufacturer.

FINISHES

Enclosures: Manufacturer's standard enamel over corrosion resistant pretreatment weatherproof NEMA 1.

SOURCE QUALITY CONTROL

Factory test components, assembled switches, and associated equipment to ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for conformance with specified requirements. Perform dielectric strength test conforming to NEMA ICS 1.

PART 3 - EXECUTION

INSTALLATION

WIRING TO REMOTE COMPONENTS

Match the type and number of cables and conductors to the control and communications requirements of the transfer switches used. Increase raceway sizes at no additional cost to the owner if necessary to accommodate required wiring.

CONNECTIONS

Tighten factory-made connections, including connectors, terminals, bus joints, mountings, and grounding. Tighten field connected connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque tightening values. When manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and 486B.

GROUNDING

Make equipment grounding connections for transfer switch units as indicated and as required by the NEC.

FIELD QUALITY CONTROL

Manufacturer's Field Services: Provide services of a factory- authorized service representative to supervise field tests.

Preliminary Tests: Perform electrical tests as recommended by the manufacturer and as follows:

Measure phase-to-phase and phase-to-ground insulation resistance levels with insulation resistance tester, including external enunciator and control circuits. Use test voltages and procedure recommended by the manufacturer. Meet manufacturer's specified minimum resistance.

Check for electrical continuity of circuits and for short circuits.

Field Tests: Give 7-day advance notice of the tests and perform tests in presence of owner's representative.

Coordinate tests with tests of generator plant and run them concurrently.

Tests: As recommended by the manufacturer and as follows:

Contact Resistance Test: Measure resistance of power contacts for ATS's, NATS's, and BP/IS's. Resolve values in excess of 500 micro-ohms and differences between adjacent poles exceeding 50%.

Ground Fault Tests: Coordinate with testing specified in Division 26 Section "Over current Protective Devices" to ensure sensors are properly selected and located to optimize ground-fault protection where power is being delivered from either source.

Verify grounding points and sensor ratings and locations.

Apply simulated fault current at the sensors and observe reaction of circuit interrupting devices.

Operational Tests: Demonstrate interlock, sequence, and operational function for each switch at least three (3) times.

Simulate power failures of normal source to ATS's and of emergency source with normal source available.

Simulate low phase-to-ground voltage for each phase of normal source of ATS's.

Verify time-delay settings and pick-up and drop-out voltages.

Test Failures: Correct deficiencies identified by tests and prepare for retest. Verify that equipment meets the specified requirements.

Reports: Maintain a written record of observations and tests. Report defective materials and workmanship and retest corrected items. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

Remote Monitoring and Control: ATS manufacturer should provide for setup and startup support (at minimum) as necessary for remote monitoring and control software, and configuration of ATS components (if required) at installation / setup phase. Verify operation of remote monitoring and control functions. Provide written report. Correct deficiencies as needed.

DEMONSTRATION

Training: Furnish the services of a factory-authorized service representative to instruct Owner's personnel in the operation, maintenance, and adjustment of transfer switches and related equipment. Provide a minimum of 4 hours of instruction scheduled 7 days in advance.

END OF SECTION 263623

SECTION 264313 – TRANSIENT VOLTAGE SURGE SUPPRESSION

Transient Surge Protector. Suppressors shall meet the following criteria:

Service Entrance: UL 1449 listed for category C3 locations per ANSI/IEEE 662.41-1991 (20 KV, 10 KA, 90 deg. Phase). Modes of suppression: L-N, N-G. Minimum single surge rating (L-N): 75,000 amp per phase. UL 1449 clamping voltage: class 1000 (Bi-wave 6 KV, 3 KA) 277/480V.

Maximum continuous operating voltage: Nominal + 15%. Pulse life: 1000 category C impulses.

Panelboards: UL 1449 listed for category B locations. Modes of suppression L-L, L-N, L-G. Minimum single surge rating (L-N): 20,000 amp per phase. UL 1449 clamping voltage: class 1000 (Bi-wave 6 KV, 3KA) 277/480V. Operating voltage: Nominal + 15%.

Device shall not bond neutral and ground under failure mode. Pulse Life: 500 category B impulses.

INSTALLATION

Install on service switchboard and panelboards per manufacturer instructions. Conductors shall be kept short and straight. Device shall be close nipped to panel.

Approved Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include but are not limited to the following:

Advanced Protection Technologies
Leviton
L.E.A. Dynatech
Liebert
EFI

END OF SECTION 264313

SECTION 265113 – INTERIOR AND EXTERIOR LIGHTING

PART 1 – GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes interior lighting fixtures, lamps, ballasts, emergency lighting units, and accessories.

DEFINITIONS

Fixture: A complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute the light, position and protect lamps, and connect lamps to the power supply. Internal battery powered exit signs and emergency lighting units also include a battery and the means for controlling and recharging the battery. Emergency lighting units are available with and without integral lamp heads and lamps.

Luminaire: Fixture.

Average Life: The time after which 50 percent will have failed and 50 percent will have survived under normal conditions.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data describing fixtures, lamps, ballasts, and emergency lighting units. Arrange product data for fixtures in order of fixture designation. Include data on features and accessories and the following information:

Outline drawings of fixtures indicating dimensions and principal features.

Electrical ratings and photometric data with specified lamps and certified results of independent laboratory tests.

Data on batteries and chargers of emergency lighting units.

Maintenance data for products for inclusion in Operating and Maintenance Manual specified in Division 01.

Product certifications signed by manufacturers of lighting fixtures certifying that their fixtures comply with specified requirements.

Shop drawings from manufactures detailing nonstandard fixtures and indicating dimensions, weights, methods of field assembly, components, features, and accessories.

Coordination drawings for fixtures mounted on, in, or above the ceiling indicating coordination with ceiling grids and other equipment installed in the same space.

QUALITY ASSURANCE

Comply with NFPA 70 "National Electrical Code " for components and installation.

Listing and Labeling: Provide fixtures and emergency lighting units that are listed and labeled for their indicated use on the Project.

Special Listing and Labeling: Provide fixtures for use in damp or wet locations.

The terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

Listing and Labeling Agency Qualification: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

Manufacturers Qualifications: Firms experienced in manufacturing fixtures that are similar to those indicated for this Project and that have a record of successful in-service performance.

Coordination of Fixtures with Ceiling: Coordinate fixtures mounting hardware and trim with the ceiling system.

EXTRA MATERIALS

Furnish extra materials matching products installed, as described below, packaged with protective covering for storage, and identified with labels describing contents. Deliver extra materials to the Owner.

Complete Fixtures: A quantity equal to 10 percent of installed units of the following type:

Lamps: 10 lamps for each 100 of each type and rating installed. Furnish at least 1 of each type.

Plastic Diffusers and Lenses: 1 for each 100 of each type and rating installed. Furnish at least 1 of each type.

Ballasts: 1 for each 100 of each type and rating installed. Furnish at least 1 of each type.

Globes and Guards: 1 for each 20 of each type and rating installed. Furnish at least 1 of each type.

PART 2 – PRODUCTS

FIXTURES, GENERAL

Comply with the requirements specified in the Articles below, lighting fixture data sheet at the end of this Section, and lighting fixture schedule.

FIXTURE COMPONENTS, GENERAL

Metal Parts: Free from burrs and sharp corners and edges.

Sheet Metal Components: Steel, except as indicated. Components are formed and supported to prevent warping and sagging.

Doors, Frames, and Other Internal Access: Smooth operating and free from light leakage under operating conditions. Arrange to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in the operating position.

Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:

White Surfaces: 85 percent.

Specular Surfaces: 83 percent.

Diffusing Specular Surfaces: 75 percent.

Laminated Silver Metallized Film: 90 percent.

Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal glass except as indicated.

Plastic: Highly resistance to yellowing and other changes due to aging, exposure to heat and UV radiation.

Lens Thickness: 0.125 inches, minimum.

SUSPENDED FIXTURE SUPPORT COMPONENTS

Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.

Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.

Rod Hangers: 3/16-inch diameter cadmium plated, threaded steel rod.

Hook Hanger: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking type plug.

FLUORESCENT FIXTURES

Fixtures: Conform to UL 1570, "Fluorescent Lighting Fixtures."

Certification: By Electrical Testing Laboratory (ETL).

Labeling: By Certified Ballast Manufacturers Association (CBM).

Type: Class P, high-power-factor type except as indicated otherwise.

Sound Rating: A rating, except as indicated otherwise.

Voltage: Match connected circuits.

Low Temperature Ballast Minimum Starting Temperature: Minus 20 deg C.

Electronic Ballasts: Solid-state, full light output, energy- saving type compatible with energy saving lamps. Conform to FCC Regulations Part 15, Subpart J. for electromagnetic interference. Conform to IEEE C62.41, "Guide for Surge Voltages in Low-Voltage AC Power Circuits," Category A, for resistance to voltage surges for normal and common modes.

Minimum Power Factor: 90 percent.

Minimum Operating Frequency: 20,000 Hz.

Third Harmonic Content of Ballast Current: Less than 20 percent.

Average Input: The following is the average required wattage when tested according to ANSI C82.2, "Fluorescent Lamp Ballasts, Methods of Measurement."

71 or less watts when operating two T-8 lamps.

36 or less watts when operating one T-8 lamp.

Electromagnetic Interference Filters: Integral to the fixture assembly. Provide one filter for each ballast. Suppress electromagnetic interference as required by MIL-STD-461, "Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference."

Static Fixture: Slots blanked, with fixture appearance matching active units.

HIGH INTENSITY DISCHARGE (HID) FIXTURES

Fixtures: Conform to UL 1572, "High-Intensity Discharge Lighting Fixtures."

Ballasts: Conform to UL 1029, "High-Intensity-Discharge Lamp Ballasts" and ANSI C82.4, "Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)." Provide ballasts with the following features, except as otherwise indicated.

Constant wattage autotransformer (CWA) or regulator, high- power- factor type.

Voltage rating matches system voltage.

Single-Lamp Ballasts: Minimum starting temperature of minus 30 deg C.

Normal ambient operating temperature is 40 deg C.

Open circuit operation will not reduce the average life.

High pressure sodium (HPS) ballasts incorporate a solid-state ignitor/starter with an average life in the pulsing mode of 10,000 hours at an ignitor/starter case temperature of 90 deg C.

Noise Suppression: Manufacturer's standard epoxy encapsulated model designed to minimize audible fixture noise.

Instant Restrike Device: Solid-state, potted module, mounted inside fixture, and compatible with mogul-based HPS lamps, ballasts, and sockets up to 150 watts.

Restrike Range: 105 to 130 VAC.

Maximum Voltage: 250 volts peak or 150 VAC RMS.

Auxiliary, Instant-On, Quartz System: Automatically switches quartz lamp when the fixture is initially energized and when momentary power outages occur. Turn quartz lamp off automatically when HID lamp reaches approximately 60-percent light output. Ballasts have internal components independent of the incoming line voltage.

INCANDESCENT FIXTURES

Conform to UL 1571, "Incandescent Lighting Fixtures."

EXIT SIGNS

Conform to UL 924, "Emergency Lighting and Power Equipment," and the following:

Sign Colors: Conform to local code.

Minimum Height of Letters: Conform to local code.

Arrows: Include as indicated.

FINISH

Steel Parts: Manufacturer's standard finish applied over corrosion- resistant primer, free of streaks, runs, holidays, stains, blisters, and defects. Remove fixtures showing evidence of corrosion during project warranty period and replace with new fixtures.

Other Parts: Manufacturer's standard finish.

PART 3 – EXECUTION

INSTALLATION

Setting and Securing: Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer's printed instructions and approved shop drawings.

Support For Recessed and Semi-recessed Fixtures: Install units may be supported from suspended ceiling support system. Install ceiling system support rods or wires at a minimum of four rods or wires per fixture located not more than 6 inches from fixture corners.

Fixtures Smaller Than Ceiling Grid: Install a minimum of four rods or wires for each fixture and locate at corner of the ceiling grid where the fixture is located. Do not support fixtures by ceiling acoustical panels.

Fixtures of Sizes Less Than Ceiling Grid: Center in the acoustical panel. Support fixtures independently with at least two 3/4-inch metal channels spanning and secured to the ceiling tees.

Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corners.

Support for Suspended Fixtures: Brace pendants and rods that are 4-feet long or longer to limit swinging. Support stem mounted single unit suspended fluorescent fixtures with twin stem hangers. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end.

Lamping: Lamp units according to manufacturer's instructions.

FIELD QUALITY CONTROL

Inspect each installed fixture for damage. Replace damaged fixtures and components.

Give advance notice of dates and times for field tests.

Provide instruments to make and record test results.

Tests: Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include the following in tests of emergency lighting equipment.

Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

ADJUSTING AND CLEANING

Clean fixtures upon completion of installation. Use methods and materials recommended by manufacturer.

Adjust amiable fixtures to provide required light intensities.

END OF SECTION 265113

SECTION 283153 – FIRE ALARM SYSTEM

PART 1 - GENERAL

RELATED DOCUMENTS

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

This contractor shall with the supervision of the county fire alarm technicians test the complete system before any work is done. This test shall note any operational or equipment malfunctions. The test results shall be submitted to the owner.

Certification of the system is a requirement of this specification.

SUMMARY

This Section includes fire alarm systems, including manual stations, detectors, signal equipment, controls, and devices.

DEFINITIONS

Alarm Initiating Device: A manual station, smoke detector, heat detector, flame detector, or sprinkler water-flow switch.

Alarm Signal: Signifies a state of emergency requiring immediate action. Pertains to signals such as the operation of a manual station and the operation of a sprinkler system flow switch.

Class A Wiring: Circuits arranged and electrically supervised so a single break or single ground fault condition will be indicated by a trouble signal at the fire alarm control panel (FACP) and the circuit will continue to be capable of operation for its intended service in the faulted condition no matter where the break or ground fault condition occurs.

Class B Wiring: Circuits electrically supervised such that a single break or a single ground fault condition will be indicated by a trouble signal at the FACP no matter where the break or ground fault condition occurs.

Hardwired System: Alarm, supervisory, and initiating devices directly connected, through individual dedicated conductors, to a central control panel without the use of multiplexing circuits or devices.

Multiplex System: One using signaling method characterized by the simultaneous or sequential transmission, or both, and the reception of multiple signals in a communication channel, including means for positively identifying each signal.

Supervisory Signal: Indicates abnormal status or need for action regarding fire suppression or other protective system.

Trouble Signal: Indicates that a fault, such as an open circuit or ground, has occurred in the system.

Zone: Initiating device or combination of devices connected to a single alarm-initiating device circuit.

SYSTEM DESCRIPTION

General: Complete new multiplexed noncoded, microprocessor-based voice evacuation fire detection and alarm system with manual and automatic alarm initiation, analog addressable smoke detectors, and automatic alarm verification for alarms initiated by smoke detector, pull stations, etc.

Signal Transmission: Hard-wired, using separate individual circuits for each zone of alarm initiation and alarm device operation.

Signal Transmission: Multiplex signal transmission dedicated to fire alarm service only.

Audible Alarm Indication: By sounding of voice evacuation type strobes on loudspeakers.

Audible Alarm Indication: BY sounding of pre-recorded voice on loudspeakers with ADA flashing light indicators.

System connections for alarm initiation and alarm indicating circuits: Class A wiring.

Functional Description: The following are required system functions and operating features:

Priority of Signals: Accomplish automatic response functions by the first zone initiated. Alarm functions resulting from initiation by the first zone are not altered by subsequent alarms. The highest priority is an alarm signal. Supervisory and trouble signals have second- and third level priority. Signals of a higher level priority take precedence over signals of lower priority even though the lower priority condition occurred first. Annunciate all alarm signals regardless of priority or order received.

Provide interface as required to disable / shutoff gym sound system and turn on gym lights upon activation of fire alarm system.

Non-interfering: Zone, power, wire, and supervise the system so a signal on one zone does not prevent the receipt of signals from any other zone. All zones are manually re-settable from the FACP after the initiating device or devices are restored to normal. Systems that require the use of batteries or battery backup for the programming function are not acceptable.

Signal Initiation: The manual or automatic operation of an alarm-initiating or supervisory-operating device causes the FACP to transmit an appropriate signal including:

- General alarm
- Fire suppression system operation alarm
- Smoke detector alarm
- Valve tamper supervisory
- Fire pump power supervisory
- Door release
- Elevator recall
- Elevator shutdown
- Dumbwaiter shutdown
- System trouble
- Fan shutdown
- Smoke control initiation

Silencing at FACP: Switches provide capability for acknowledgment of alarm; supervisory, trouble, and other specified signals at the FACP; and capability to silence the local audible signal and light a light-emitting diode (LED). Subsequent zone alarms cause the audible signal to sound again until silenced in turn by switch operation. Restoration to normal of alarm, supervisory, and trouble conditions extinguish the associated LED and cause the audible signal to sound again until the restoration is acknowledged by switch operation.

Loss of primary power at the FACP/voice evacuation panel sounds trouble signal at the FACP and indicates at the FACP when the system is operating on an alternate power supply.

Loss of primary power at the FACP or FAAC/ voice evacuation panel sounds trouble signal at the FACP and the annunciator. An emergency power light is illuminated at both locations when the system is operating on an alternate power supply.

Annunciation: Manual and automatic operation of alarm- and supervisory-initiating devices is annunciated both on the FACP and on the annunciator, indicating the location and type device.

FACP Alphanumeric Display: Displays plain language description of alarms, trouble signals, supervisory signals, monitoring actions, system and component status, and system commands.

General Alarm: A system general alarm includes:

Indicating the general alarm condition at the FACP and the annunciator.

- a) Identifying the device that is the source of the alarm (or its zone) at the FACP and the annunciator.
- b) Initiating audible and visible alarm signals throughout the building.
- c) Initiating elevators' automatic recall operation.
- d) Closing fire and smoke doors normally held open by magnetic door holders.
- e) Stopping supply and return fans serving zone where alarm is initiated.
- f) Close gas solenoid valves.
- g) Recording the event on the system printer.
- h) Initiating transmission of alarm signal to remote central station.

Manual station alarm operation initiates a general alarm.

Smoke detection initiates a general alarm.

Smoke detection for zones without alarm verification initiates a general alarm.

Smoke detection for a zone with alarm verification causes the following:

- a) Audible and visible indication of an "alarm verification" signal at the FACP.
- b) Activation of a listed and approved "alarm verification" sequence at the FACP and the detector.
- c) Recording of the event on the system printer.
- d) General alarm initiation if the alarm is verified.
- e) FACP indication cancellation and system reset if the alarm is not verified.

Remote Detector Sensitivity Adjustment: Manipulation of controls at the FACP causes the selection of specific addressable smoke detectors for adjustment, display of their current status and sensitivity settings, and control of changes in those settings. The same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific detectors. Sensitivity adjustments and sensitivity adjustment schedule changes are recorded by the system printer.

Recording of Events: Record all alarm, supervisory, and trouble events by means of system printer. Printouts are by zone, device, and function. When the FACP receives a signal, the alarm, supervisory, and trouble conditions are printed. The printout includes the type of signal (alarm, supervisory, or trouble) the zone identification, date, and the time of the occurrence. The printout differentiates alarm signals from all other printed indications. When the system is reset, this event is also printed, including the same information concerning device, location, date, and time. A command initiates the printout of a list of existing alarm, supervisory, and trouble conditions in the system.

1. Permissible Signal Time Elapse: The maximum permissible elapsed time between the actuation of any fire alarm or fire- detection system alarm-initiating device and its indication at the FACP is two seconds.
2. Independent System Monitoring: Supervise each independent smoke detection system, duct detector, and elevator smoke detection system for both normal operation and trouble.
3. Circuit Supervision: Indicate circuit faults by means of both a zone and a trouble signal at the FACP. Provide a distinctive indicating audible tone and (LED) indicating light. The maximum elapsed time between the occurrence of the trouble condition and its indication at the FACP is 200 seconds.

SUBMITTALS

General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

Product data for system components. Include dimensioned plans and elevations showing minimum clearances and installed features and devices. Include list of materials and NRTL-listing data.

Wiring diagrams from manufacturer differentiating between factory- and field installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Indicate components for both field and factory wiring.

Shop drawings showing details of graphic annunciator.

System operation description covering this specific Project including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.

Operating instructions for mounting at the FACP.

Operation and maintenance data for inclusion in Operating and Maintenance Manual specified in Division 1. Include data for each type product, including all features and operating sequences, both automatic and manual. Include recommendations for spare parts to be stocked at the site.

Provide the names, addresses, and telephone numbers of service organizations that carry stock of repair parts for the system to be furnished.

Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.

Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of annotated Contract Drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, submit them for review. Make resubmissions if required to make clarifications or revisions to obtain approval.

Record of field tests of system.

QUALITY ASSURANCE

Installer Qualifications: A factory authorized Installer is to perform the Work of this Section.

Compliance With Local Requirements: Comply with the applicable building code, local ordinances, and regulations, and the requirements of the authority having jurisdiction.

Comply with NFPA 70, "National Electrical Code."

NFPA Compliance: Provide fire alarm and detection systems conforming to the requirements of the following publications:

NFPA 72, "National Fire Alarm Code."

NRTL Listing: Provide systems and equipment that are listed and labeled.

Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.

Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

FM Compliance: Provide fire alarm systems and components that are FM-approved.

Single Source Responsibility: Obtain fire alarm components from a single source who assumes responsibility for compatibility for system components.

PART 2 – PRODUCTS

MANUFACTURER

This project consists of providing a complete new fire alarm system. Johnson Controls, Simple 4100ES Addressable System. No other manufacturer or equipment will be accepted.

MANUAL PULL STATIONS

Description: Double action addressable type, fabricated of metal or plastic, and finished in red with molded, raised-letter operating instructions of contrasting color. Stations requiring the breaking of a glass panel are not acceptable. Stations requiring the breaking of a concealed glass rod may be provided.

Station Reset: Key- or wrench operated, double pole, double- throw, switch rated for the voltage and current at which it operates. Stations have screw terminals for connections.

Each pull station shall be protected by a hinged clear polycarbonate shield/cover with a local buzzer and arming switch.

SMOKE DETECTORS

General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:

Factory Nameplate: Serial number and type identification.

Operating Voltage: 24-V d.c., nominal.

Self Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

Plug-in Arrangement: Detector and associated encapsulated electronic components are mounted in a module that connects to a fixed base with a twist locking plug connection. The plug connection requires no springs for secure mounting and contact maintenance. Terminals in the fixed base accept building wiring.

Visual Indicator: Connected to indicate detector has operated.

Addressability: Detectors include a communication transmitter and receiver having a unique identification and capability for status reporting to the FACP.

Remote Controllability: Individually monitor detectors at the FACP for calibration, sensitivity, and alarm condition, and individually adjust for sensitivity from the FACP.

Photoelectric Smoke Detectors: Include the following features and characteristics:

Detector Sensitivity: Between 2.5- and 3.5 percent per foot smoke obscuration when tested according to UL 268.

Sensor: An infrared detector light source with matching silicon cell receiver.

Ionization Type Smoke Detector: Multiple chamber type operating on the ionization principle and actuated by the presence of invisible products of combustion.

Duct Smoke Detector: Ionization type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Detector includes relay as required for fan shutdown, and shall be provided with remote indicator.

OTHER DETECTORS

Thermal Detector: Addressable combination fixed-temperature and rate-of-rise unit with mounting plate arranged for outlet box mounting; 135- deg F fixed-temperature setting except as indicated.

Addressable Thermal Detector: Rate compensated/fixed temperature type with plug-in base and alarm indication lamp. Detectors have a communication transmitter and receiver with unique identification and capability for status-reporting to the FACP.

Flame Detector: Ultraviolet type with plug-in base and solid- state amplifier-switching circuit set for 10-second delay unless otherwise indicated.

Addressable Flame Detector: Ultraviolet type with plug-in base and solid-state, amplifier-switching circuit set for 10-second delay unless otherwise indicated. Detectors have a communication transmitter and receiver with unique identification and capability for status-reporting to the FACP.

ALARM INDICATING DEVICES

General: Equip alarm indicating devices for mounting as indicated. Provide terminal blocks for system connections.

Addressable Interface Units: Arrange to monitor one or more system components that are not otherwise equipped for multiplex communication. Units transmit identification and status to the FACP using a communication transmitter and receiver with unique identification and capability for status-reporting to the FACP.

Fire Alarm Speakers: Voice evacuation type operating on 24-V DC, with provision for housing the operating mechanism behind a grille. Speakers produce a sound pressure level of 90 dB, measured 10 feet from the source.

Visual Alarm Devices: 24-V DC strobe lights with clear polycarbonate lens and xenon flash tube. Mount lenses on an aluminum face plate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.

Lamps have a minimum peak intensity of 8,000 candlepower (75cd min). Strobe leads are factory connected to screw terminals.

Combination devices consist of factory-combined, audible and visual alarm units in a single mounting assembly.

Voice/Tone Speakers: Comply with UL 1480, "Speakers for Fire Protective Signaling."

Speakers: Compression driver type with flared projectors having a frequency response of 400 to 5000 Hz; equipped with an alnico-V magnet and a multiple tap, varnish impregnated, sealed, matching transformer. Match transformer tap range and speaker power rating to the acoustical environment of the speaker location.

High Range Speaker Units: Rated 2-15 watts.

Low Range Speaker Units: Rated 1-2 watts.

Speaker Mounting: Flush, semi-recessed, surface, or surface- mounted bi-directional as indicated.

MAGNETIC DOOR HOLDERS

Description: Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Electromagnet operates from a 120-V AC source and requires no more than 3 watts to develop 25 lbs. holding force.

Material and Finish: Match door hardware.

FIRE ALARM CONTROL PANEL (FACP)

General: Comply with UL 864, "Control Units for Fire-Protective Signaling Systems."

Systems: Alarm and supervisory systems are separate and independent in the FACP. The alarm initiating zone boards in the FACP consist of plug-in cards. Construction requiring removal of field wiring for module replacement is not acceptable.

Control Modules: Types and capacities required to perform all functions of the fire alarm systems. Local, visible, and audible signals notify of alarm, supervisory, and trouble conditions. Each type of audible alarm has a distinctly different sound.

Zones: Provide for all alarm and supervisory zones as required.

FIRE ALARM AUXILIARY CABINET

General: FAACs will house auxiliary power supplies and modular control and monitoring modules for each building.

Capacity: Each FAAC shall be expandable to at least two (2) times the number of devices shown for the building where installed.

The FACP, FAVE and each FAAP shall include battery backup, charger and monitoring to maintain operation of system during loss of primary power source. Duration and capacities per NFPA and SREF required.

PART 3 – EXECUTION

INSTALLATION, GENERAL

Install system according to NFPA Standards referenced in Parts 1 and 2 of this Section.

Fire Alarm Power Supply Disconnect: Paint red and label "FIRE ALARM." Provide with lockable handle or cover.

EQUIPMENT INSTALLATION

Manual Pull Stations: Mount semi flush in recessed back boxes with operating handles 48-inches above finished floor or as indicated.

Smoke Detectors: Install ceiling mounted detectors not less than 4 inches from a side wall to the near edge. Install detectors located on the wall at least 4 inches but not more than 12 inches below the ceiling. For exposed solid joist construction, mount detectors on the bottoms of the joists. On smooth ceilings, install detectors not over 30 feet apart in any direction. Install detectors no closer than 5 feet from air registers.

Audible Alarm Indicating Devices: Install at 80" above the finished floor, nor less than 6" below the ceiling. Install bells and horns on flush mounted back boxes with the device operating mechanism concealed behind a grille or as indicated. Combine audible and visual alarms at the same location into a single unit.

Visual Alarm Indicating Devices: Install adjacent to each alarm bell or alarm horn and not less than 80 inches above the finished floor and at least 6" below the ceiling.

Device Location Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

Fire Alarm Control Panel (FACP): Surface mount with tops of cabinets not more than 6' above the finished floor.

Graphic Annunciator: Arrange as indicated, with the top of the panel no more than 6' above the finished floor.

WIRING INSTALLATION

Wiring Method: Install wiring in metal raceway according to Division 16, Section "Raceways". Conceal raceway except in unfinished spaces and as indicated.

Wiring within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the wiring diagrams of the system. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

Cable Taps: Use numbered terminal strips in junction, pull or outlet boxes, cabinets, or equipment enclosures where any circuit tap is made.

System Wiring: For the low voltage portion of the fire alarm system, install No. 16 AWG conductors and 75-deg C insulation in wet, damp, or dry locations. For line voltage wiring, install No. 12 AWG size with insulation rated 75 deg C minimum.

Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuits wiring and a different color code for supervisory circuits. Color code audible alarm indicating circuits differently from alarm initiating circuits. Use different colors for visual alarm indicating devices. Paint fire alarm system junction boxes and covers red.

GROUNDING

Ground equipment and conductor and cable shields. For audio circuits, minimize to the greatest extent possible ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5 OHM ground at main equipment location. Measure, record, and report ground resistance.

CIRCUITING GUIDELINES

No loop shall be loaded to more than 50% of the maximum allowable number of devices which can be connected to the loop.

FIELD QUALITY CONTROL

Manufacturer's Field Services: Provide services of a factory- authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

Pretesting: Upon completing installation of the system, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of the witnesses to the preliminary tests.

Final Test Notice: Provide a ten (10) day minimum notice in writing when the system is ready for final acceptance testing.

Minimum System Tests: Test the system according to the procedures outlined in NFPA 72H, Chapters 2 and 4, and NFPA 72E, Chapter 8. Minimum required tests are as follows:

Verify the absence of unwanted voltages between circuit conductors and ground.

Megger test all conductors other than those intentionally and permanently grounded with electronic components disconnected. Test for resistance to ground. Report readings less than 1- megohm for evaluation.

Test all conductors for short circuits utilizing an insulation testing device.

With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on the record drawings.

Verify the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.

Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of the initiating and indicating devices. Observe proper signal transmission according to class of wiring used.

Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion. Provide sensitivity test for all smoke detectors.

Test the system for all specified functions according to the manufacturer's operating and maintenance manual. Systematically initiate specified functional performance items at each station

including making all possible alarm and monitoring initiations and using all communication options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.

Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the period and in the manner specified.

Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.

Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

Upon completion of testing and verification that system is operating properly, provide certification as required by N.F.P.A. 72.

SPARE DEVICES

In addition to all devices indicated on the plans, the Contractor shall provide AND INSTALL two (2) of each of the following devices:

- Smoke Detector
- Heat Detector
- Pull Station
- Speaker/Strobe

Location of each device shall be specified by the engineer prior to substantial completion. If these devices are not installed, then a credit back to the Owner is required.

CLEANING AND ADJUSTING

Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

DEMONSTRATION

Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.

Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours' training.

Schedule training with the Owner at least seven days in advance.

END OF SECTION 283153

Appendix A

Construction Drawings
