

**WILLIAM J. RISH STATE PARK
District 1
Gulf County**

RISH PARK FULL DESIGN TASKS

**Florida Department of Environmental Protection
Division of Recreation and Parks
Bureau of Design and Construction
3800 Commonwealth Boulevard
Tallahassee, Florida 32399**

CPH Job No. F13622.2

January 2024



DOCUMENT 00 01 07
SEALS PAGE

PART 1 - GENERAL

1.1 DESIGN PROFESSIONALS OF RECORD

A. Architect:

1. Brook K. Sherrard, A.I.A.
2. AR92948
3. Responsible for Divisions 01-49 Sections except where indicated as prepared by other design professionals of record.

B. Civil Engineer: Specifications on Plan Sheets.

C. Landscape Architect: - not applicable

D. Structural Engineer:

1. Jose Ortiz, MCE, PE, SE
2. PE67920
3. Responsible for 03 01 00, 03 20 00, 03 30 00, 04 22 00, 05 12 00, 06 16 00, 06 17 53

E. Plumbing Engineer:

1. Jeff Deal, PE
2. PE87451
3. Responsible for all Division 23

F. HVAC Engineer:

1. Jeff Deal, PE
2. PE87451
3. Responsible for all Division 22

G. Electrical Engineer:

1. Alexander E. Zvonaryov, P.E., MLE
2. PE60953
3. Responsible for all Division 26, 27 & 28

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
2. Openings for other work.
3. Form accessories.
4. Form stripping.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including Contractual Conditions and Divisions 1 Specification Sections, apply to this section.

1.3 REFERENCE STANDARDS

- A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.
- B. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- D. ACI 347R - Guide to Formwork for Concrete; 2014.
- E. ASME A17.1 - Safety Code for Elevators and Escalators; 2013.
- F. PS 1 - Structural Plywood; 2009

1.4 SUBMITTALS

- A. See Section 01-30-00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on void form materials and installation requirements.
- C. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.
- D. Delegated Design Data: As required by authorities having jurisdiction.

1.5 QUALITY ASSURANCE

PART 2 PRODUCTS

2.1 FORMWORK - GENERAL

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.
- C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.
- D. Comply with relevant portions of ACI 347R, ACI 301, and ACI 318.

2.2 WOOD FORM MATERIALS

- A. Softwood Plywood: PS 1, B-B High Density Concrete Form Overlay, Class I. 3/4 inch Minimum thickness.

2.3 REMOVABLE PREFABRICATED FORMS

- A. Preformed Steel Forms: Minimum 16 gage, 0.0598 inch thick, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- B. Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, of sizes indicated.
- C. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 2 inches thick. .

2.4 FORMWORK ACCESSORIES

- A. Form Ties: Snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, 1 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.
 - 1. Provide stainless steel form ties for all exterior surfaces exposed to view.
 - 2. Approved Manufacturers:
 - a. Dayton: "Sure-Grip"
 - b. Henchman: "Snapties"
 - c. Richmond: "Snop-Tys"
- B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

1. Composition: Colorless reactive, mineral oil-based, soy-based, or vegetable-oil based compound.
 2. Do not use materials containing diesel oil or petroleum-based compounds.
 3. VOC Content: In compliance with applicable local, State, and federal regulations.
- C. Filler Strips for Chamfered Corners: Wood strip type; 3/4 by 3/4 inch size; maximum possible lengths.
- D. Dovetail Anchor Slot: Galvanized steel, at least 22 gage, 0.0299 inch thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- E. Dovetail Anchor Slot: Zinc coated (oriented vertically) shall be located at 3 feet - 0 inches on center horizontally wherever concrete surfaces adjoin masonry. Where concrete masonry units (CMU) abut columns, provide dovetail slot at centerline of adjoining CMU.
1. Approved Manufacturers:
 - a. Henchman: Number 100 Standard, 24 gauge
 - b. Hohmann & Barnard, Inc. Number 305
 - c. Wire Products Company, Number F-17
 - d. Gateway Building Products: DAS-STD
- F. Flashing Reglets: Galvanized steel, at least 22 gage, 0.0299 inch thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- G. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- H. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05-12-00.
- I. Decorative Form liners: Basis of Design Pattern 1205 Smooth Ship Lap by Spec Formliners, Inc. 1-(844) 429-9500, specformliners.com
- J. Form Liner Release: Spec Release by Spec Formliners, Inc. 1-(844) 429-9500, specformliners.com

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval before framing openings in structural members that are not indicated on drawings.
- F. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
- G. Coordinate this section with other sections of work that require attachment of components to formwork.

3.3 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.4 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items that will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- D. Position recessed anchor slots for brick veneer masonry anchors to spacing and intervals specified in Section 04-20-01.
- E. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.5 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
 - 1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.6 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.
- B. Construct permanent insulated foam panel formwork to maintain tolerances required by ACI 301.
- C. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.
- D. Camber slabs and beams in accordance with ACI 301.

3.7 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01-40-00 - Quality Requirements.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.
- C. Do not reuse wood formwork more than 3 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.8 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION 03 10 00

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reinforcing steel for cast-in-place concrete.
2. Supports and accessories for steel reinforcement.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including Contractual Conditions and Divisions 1 Specification Sections, apply to this section.

1.3 REFERENCE STANDARDS

- A. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- B. ACI SP-66 - ACI Detailing Manual; 2004.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- D. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2007b (Reapproved 2014).
- E. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2014.
- F. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars; 2001 (Reapproved 2007).
- G. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.
- H. CRSI (DA4) - Manual of Standard Practice; 2009.

1.4 SUBMITTALS

- A. See Section 01-30-00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
- C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.
- D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.5 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301.

- B. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 - 1. Plain billet-steel bars. for bars numbers 3 to number 18.
 - 2. Epoxy coated in accordance with ASTM A775/A775M.
- B. Steel Welded Wire Reinforcement (WWR): Class A epoxy coated, deformed type; ASTM A884/A884M.
- C. Reinforcement Accessories:
 - 1. Tie Wire: Federal specifications QQ-W-461 Annealed steel, minimum 16 gage, 0.0508 inch for use on epoxy coated steel reinforcement.
 - 2. Bar Supports and Spacers:
 - a. For unexposed concrete, bar supports and spacers shall be manufactured of standard brights basic wire upturned legs.
 - b. For concrete which will be exposed to view from the underside upon completion of the structures, use plastic capped bar supports and spacers.
 - c. For slabs on grade, use bolsters with runners where base will not support chair legs.
 - d. Do not use wood, brick or other non-specified material.
 - 3. Welded electrodes: AWS A5.1, Low Hydrogen, E70 Series.
 - 4. Welded Inserts: Provide wedge inserts for the support of brick ledger angles. Wedge inserts shall be placed at 4'-0" o.c. unless drawings indicate a more restrictive spacing. Provide the F-7 wedge insert and 3/4" diameter askew bolt, nut and washers as manufactured by Dayton Superior, 10101 C General Drive, Orlando, Florida, or equal.
 - a. Wedge inserts and 3/4" diameter bolts to be deemed equal shall submit test information documenting an ultimate capacity of at least 8,500 pounds when the shelf angle is loaded 2-1/4" from the face of concrete, with the bottom of the insert 1-1/2" clear from the beam bottom, for concrete strength of 4,000 psi.

2.2 RE-BAR SPLICING:

- A. Perform work of this section in accordance with ACI 318

2.03 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

- B. Welding of reinforcement is permitted only with the specific approval of Architect. Perform welding in accordance with AWS D1.4/D1.4M.
- C. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963/D3963M.

PART 3 EXECUTION

3.1 GENERAL:

- A. Cleaning and storage reinforcement: Steel reinforcement at the time concrete is placed shall be free from heavy rust, scale or other coating that will destroy or reduce the bond.
- B. All reinforcing steel shall be stored in neat piles at the site clear of the ground in such a manner that all bars can be readily identified when required.
- C. Excessive form oil on the reinforcing shall be removed by washing the reinforcing with kerosene. Exercise due care that no smoking or welding is permitted in the area of cleaning. Provide fire extinguisher at cleaning site.
- D. Supports for reinforcing steel: All reinforcing steel shall be rigidly supported, accurately located and held in position by the use of proper reinforcing steel supports, spacers and accessories before the concrete placement begins.
- E. The legs of all reinforcing supports shall be bent to form a foot so that the side and not the end of leg rods bears on the form.
- F. Metal reinforcement shall be protected by the thickness of the concrete indicated on the drawings. Where not otherwise shown, the concrete cover shall be not less than the following:
 - 1. 3 inches for footings and other principal structural members poured directly against the ground.
 - 2. 2 inches for bars larger than number 5, and 1-1/2 inches for number 5 bars and smaller where concrete will be exposed to the ground or weather after removal of forms.
 - 3. 1-1/2 inches in all beams, girders and columns.
 - 4. 3/4 inches for all slabs and walls not exposed to the ground or weather.
 - 5. In any event, there shall be not less than 3/4" of concrete protection over all reinforcing bars.
- G. Do not use bar supports or reinforcing as support for concrete runways or construction loads.
- H. Placing tolerances: Clear distance to formed surfaces: +/- 1/4 inch. Minimum spacing between bars: -1/4 inch:
 - 1. Top Bars in Slabs or Beams:
 - a. Members 8" or less in depth: +/- 1/4 inch
 - b. Members 8" to 24" in depth: +/- 1/4 inch
 - c. Members 24" or greater in depth: +/- 1/2 inch
 - 2. Crosswire of Slabs or Beams: Spaced evenly within 2 inches.
 - 3. Lengthwise of Member: +/- 2 inches
- I. Bending details: Typical bending and placing diagrams are shown on the drawings. For parts not shown, bending details and lengths shall conform to the requirements of the ACI Building

Code 318 and "Manual of Standard Practice for Detailing Reinforced Concrete Structures" ACI 315.

- J. Bends for stirrups and ties shall be made around a pin having the diameter no less than 1-1/2 inches for number 3, and 2 inches for number 4.
- K. Bends for other bars shall be made around a pin having a diameter not less than six bar diameters for number 3 to number 6, 8 bar diameters for number 9, number 10 and number 11, 10 bar diameters for number 14 and number 18.
- L. All bars shall be bent cold. Heating of bars will not be allowed

3.2 SPECIAL REINFORCING REQUIREMENTS:

- A. Where walls or other items are shown as built integrally with other section, but are placed as separate pours, key and dowels must be provided. Dowels shall be the same size and at the same spacing as reinforcing.
- B. Main reinforcing bars shall not be spliced unless so noted on the drawings or approved by the Architect.
- C. Provide 6 X 6 - W1.4 X W1.4 electrically welded wire fabric, ASTM A-185 reinforcing in all concrete slabs on ground unless shown otherwise.
- D. Provide corner bars of same size and spacing as main reinforcement at all intersections and corners.
- E. Where openings occur in walls, or slabs, provide two number 5 bars at all sides and extending at least two feet beyond the corners and two number 5 bars at least three feet long diagonally across each re-entrant corner.
- F. Unless permitted by an Inspector employed by the owner reinforcement shall not be bent after being embedded in hardened concrete.

3.3 INSPECTION OF REINFORCEMENT:

- A. Reinforcing placement must be checked by an Inspector employed by the owner before any concrete is placed. Any corrections shall be made before concrete is placed.
- B. Placement of reinforcing shall occur in such sequence that the Inspector has sufficient time to inspect the correctness of the reinforcing within the placement area and retains the right to require necessary revisions be made before concrete is placed.
- C. The Contractor shall notify the Inspector at least 24 hours in advance of concrete placement for a particular portion of the building.
- D. Galvanized wire ties of double loop and tightly fastened to secure the proper spacing of rods and ties are required.

3.4 LAP SPLICING:

- A. Welded wire fabric shall be overlapped wherever successive mats or rolls are continuous such that the overlap measured between outermost cross wires is not less than one wire spacing plus 2 inches.
- B. Longitudinal (continuous) footing reinforcing: Class B.
- C. Beam Reinforcing: Class B.
- D. Column Reinforcing: Class B Offset lap splices.

- E. Column/footing dowels: Class B
- F. Masonry vertical reinforcing: Class B.
- G. Splices not included above: Class B.

END OF SECTION 03 20 00

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Joint devices associated with concrete work.
 2. Miscellaneous concrete elements
 3. Concrete curing.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including Contractual Conditions and Divisions 1 Specification Sections, apply to this section.
- B. Section 03-10-00 - Concrete Forming and Accessories: Forms and accessories for formwork.
- C. Section 03-20-00 - Concrete Reinforcing.
- D. Section 07-92-00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.3 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- B. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- C. ACI 302.1R - Guide for Concrete Floor and Slab Construction; 2004 (Errata 2007).
- D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.
- E. ACI 305R - Hot Weather Concreting; 2010.
- F. ACI 306R - Cold Weather Concreting; 2010.
- G. ACI 308R - Guide to Curing Concrete; 2001 (Reapproved 2008).
- H. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- I. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.
- K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.
- L. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2012.
- M. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

- N. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2014.
- O. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- P. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.
- Q. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2014.
- R. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2014.
- S. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2010.
- T. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).
- U. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2011.
- V. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.

1.4 SUBMITTALS

- A. See Section 01-30-00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
 - 1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
 - 2. Provide certificates signed by material manufacturer, certifying that each material complies with the specified requirements.
- C. Mix Design: Submit proposed concrete mix design.
 - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
 - 2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
- D. Test Reports
 - 1. Submit results of all compression, slump and air content tests performed during mix design and throughout the duration of the project as required by the Specifications.
 - 2. Submit sieve analysis of coarse and fine aggregate intended for use in the project.
 - 3. Submit a copy of State Certification that the concrete batching and weighing equipment has been inspected and approved.
 - 4. Submit letters from the cement and aggregate suppliers certifying that furnished materials meet appropriate ASTM Standards.
- E. Samples: Submit samples of underslab vapor retarder to be used.

- F. Samples: Submit two, 12 inch long samples of construction joint devices.
- G. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- H. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.5 QUALITY ASSURANCE

- A. Do not commence placement of concrete until mix designs have been approved by the Architect.
- B. Any concrete work which does not conform to the specified requirements, including strength, tolerance and finishes shall be corrected by the Contractor at his expense and as directed by the Architect.
 - 1. Tolerances listed in sub-paragraphs of 3.03 below.
- C. Perform work of this section in accordance with ACI 301 and ACI 318.
 - 1. Maintain one copy of each document on site.
- D. Follow recommendations of ACI 305R when concreting during hot weather.
- E. Follow recommendations of ACI 306R when concreting during cold weather.

1.6 TESTING:

- A. Concrete shall be sampled and tested for Quality Control during placement of concrete.
- B. Failure to detect defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate Architect for final acceptance.
- C. Required Sampling and Testing
 - 1. Samples, for strength tests of each concrete mix shall be taken not less than once a day nor less than once for each 50 cu. yd. of concrete.
- D. If the total volume of concrete is such that the frequency of testing required above would provide less than five strength tests for a given mix, tests shall be made from at least five randomly selected batches.
 - 1. Secure composite samples in accordance with ASTM C172.
 - 2. Mold and cure five specimens from each sample in accordance with ASTM C31.
 - a. Samples for test shall be taken at the 1/4 and 3/4 points of the load mixer.
 - b. Cure specimens under laboratory conditions except as follows:
 - 1) When in the opinion of the Architect there is a possibility of the surrounding air temperature falling below 40 degrees F, he may require additional specimens to be cured under job conditions.
 - 2) In hot weather or periods of low humidity the Architect may require additional specimens to be cured under job conditions
 - (a) Test specimens in accordance with ASTM C39.
 - (1) Test one specimen at 3 days.
 - (2) Test one specimen at 7 days.
 - (3) Test two specimens at 28 days for acceptance. This test of two specimens constitutes one strength test. The results of the

strength test shall be the average of the strengths of the two specimens tested.

- (b) Hold one specimen for future use if test does not comply at 28 days.
 - (c) Determine slump of the concrete sample for each strength test and whenever consistency appears to vary, using ASTM C143.
 - (d) Determine air content for each strength test in accordance with either ASTM C231, ASTM C173, or ASTM C138.
 - (e) Determine temperature of concrete sample for each strength test.
- E. Evaluation of Test Results
- 1. For evaluation each specified concrete mix shall be represented by at least five strength tests.
- F. The strength level of the concrete will be considered satisfactory if both of the following requirements are met.
- 1. The average of all sets of three consecutive strength tests (average of two cylinders) exceeds specified strength.
 - 2. No individual strength test (average of two cylinders) falls below the specified strength by 500 psi.
- G. If the strength level does not meet the above requirements, the Architect shall consider the concrete to be deficient and shall have the right to reject the work or require load tests on the structure in the areas the tests represent at no cost to the Owner.
- H. Report tests results in writing to the Architect and the Contractor on the same day that tests are made. Reports of compressive strength tests shall contain:
- 1. Project identification name and number
 - 2. Date of concrete placement
 - 3. Name of Contractor
 - 4. Name of Concrete Supplier and Truck Number
 - 5. Name of Concrete Testing Service
 - 6. Concrete type and class
 - 7. Location of concrete batch in the structure
 - 8. Design compressive strength at 28 days
 - 9. Slump
 - 10. Air Content
 - 11. Concrete temperature
 - 12. Concrete mix identification number
 - 13. Compressive breaking strength
 - 14. Type of break for both 7-day tests and 28-day tests.
- I. TESTING SERVICES:
- 1. The Owner will employ an independent testing laboratory meeting the requirements of ASTM E329 and approved by the Architect to perform the following services:
 - a. Sample concrete at placement and make slump, air content, temperature and compression tests as described above.

- b. Report tests results to the Architect.
2. Contractor Responsibilities
 - a. Pay for additional testing and inspection of materials or concrete occasioned by their failure by test or inspection to meet specification requirements.
 - b. Provide the necessary testing services for the qualification of proposed materials and the establishment of mix designs; and for any other testing services required by the Contractor.
 - c. Furnish any necessary labor to assist the designated testing agency in obtaining and handling samples.
 - d. Advise the testing agency sufficiently in advance of operations to allow for completion of tests.
 - e. Provide and maintain for the sole use of the testing agency adequate facilities for safe storage and proper curing of concrete test specimens as required by ASTM C31.
 - f. The use of Testing Services shall in no way relieve the Contractor of the responsibility to furnish materials and construction in full compliance with the Contract Documents.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
 1. Acquire cement for entire project from same source
- B. Fine and Coarse Aggregates: ASTM C 33.
 1. Acquire aggregates for entire project from same source.
 2. Fine Aggregate: Clean, sharp sand, free from loam, clay, lumps or other deleterious substance.
 3. Coarse Aggregate For Normal Weight Concrete: Comply with ASTM C33 size #57. Clean, uncoated, processed aggregate of crushed stone or washed gravel containing no clay, mud, loam or foreign matter. Use of pit or bank run gravel is not permitted. Aggregate shall meet ASTM C33 Size No. 56 or 57.
 4. Where contractor elects to place concrete by pumping he shall provide a pump with sufficient capacity to place this size of aggregate.
 5. ASTM C404 for masonry grout. Maximum aggregate size shall be 3/8".
- C. Water: Clean and not detrimental to concrete.
 1. Water shall be fresh and potable. Water shall be obtained from city water system. The Contractor shall pay for the quantity of water used during construction and also furnish, install and maintain a water meter if required by the Water Department.

2.2 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

- B. Air Entrainment Admixture: ASTM C260/C260M.
 - 1. Manufacturers:
 - a. "Darex" by W.R. Grace.
 - b. "SikaAer" by Sika Chemical Co.
 - c. "MBVR" by Master Builders
 - d. "Air-Mix" by Euclid
 - e. "Sealtight" by W.R. Meadows

- B. High Range Water Reducing Admixture: ASTM C494/C494M Type F and shall contain no chloride ions..
 - 1. Manufacturers:
 - a. "Melmet" by American Admixtures.
 - b. "WRDA 19" by W.R. Grace Co.
 - c. "Sikament" by Sika Chemical Co.
 - 2. Dosage and use of any mix containing this admixture shall be in strict accordance with the manufacturers direction and only with the written permission of the Engineer.
 - 3. A representative of the admixture manufacturer shall be present to observe the products use and to assure that it is being used in accordance with the manufacturers directions.

- C. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
 - 1. Provide pigmented type, with ASTM C979/C979M inorganic pigments.
 - 2. Manufacturers:
 - a. "Daratard 17" by W.R. Grace & Company.
 - b. "Pozzolith 100XR" by Master Builders, Inc..
 - c. "Lubricon R" by American Admixture
 - d. "Plastocrete 161R" by Sika Chemical Co.

- D. Water Reducing Admixture: ASTM C494/C494M Type A.
 - 1. Manufacturers:
 - a. "Pozzolith 300 Series" by Master Builders.
 - b. "WRDA/HYCOL" by Grace.
 - c. "Plastocrete 161" by Sika

d. "Eucon-WR-75" by Euclid

E. Calcium Chloride

1. Do not use calcium chloride in any concrete.

2.3 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Sheet material complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.

1. Installation: Comply with ASTM E1643.
2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
3. Manufacturers:
 - a. Fortifiber Building Systems Group; Moistop Ultra 10: www.fortifiber.com/#sle.
 - b. W.R. Meadows, Inc.; PERMINATOR Class A - **10 mils**: www.wrmeadows.com.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. Products:

a. Five Star	U.S. Grout
b. Euco NS	Euclid Chemical
c. Masterflow 713	Master Builders

C. Water stop:

1. Provide rubber or PVC flat, center build type water stops

2.4 BONDING AND JOINTING PRODUCTS

A. Epoxy Bonding System:

1. Complying with ASTM C881/C881M and of Type required for specific application.
2. Manufacturers:

a. Sikadur Hi-Mod	Sika Chemical
b. Thiopoxy	W.R. Grace
c. Epoxy #452	Euclid Chemical

B. **Slab Isolation Joint Filler: Thickness as indicated in drawings. If not indicated provide 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.**

1. Material: ASTM D1751, non-staining, non-extruding and resilient bituminous type.

2.5 CURING MATERIALS

A. **Membrane curing compound:**

1. Conform to ASTM C171, Class B, Clear 100% resin type.

2. Do not use on any surface which will later receive paint, sealer, hardener, carpeting, tile or other bonded covering.
 - a. Acceptable Products:
 3. Sealtight AR-30 W.R. Meadows
 4. Kurez Euclid Chemical
 5. Horncure W.R. Grace
 6. Hydrocide Resin Sonneborn
- B. Curing/sealing compound:
 1. Sodium Silicate Sealer
 - a. Acceptable Products
 - b. Cure Hard Meadows
 - c. Eucosil Euclid Chemical
 - d. WB-309 Grace
 - e. Sonosil Sonneborn
 - f. Acurion Anti-Hydro Waterproofing
 2. Verify compatibility of finish with curing/sealing compounds.
- C. Moisture-Retaining Sheet: ASTM C171.
 1. Polyethylene film, clear, minimum nominal thickness of 0.0040 inch.
- D. Water: Potable, not detrimental to concrete.

2.6 CONCRETE MIX DESIGN

- A. Contractor shall provide all testing services for approval of mixes.
- B. The Contractor shall furnish the Architect for approval a mix design for each class of concrete at least 15 days prior to start of work.
- C. Do not begin production until mixes have been approved by Architect.
- D. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- E. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- F. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- G. Normal Weight Concrete:
 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 pounds per square inch.
 2. Water-Cement Ratio: Maximum 40 percent by weight.
 3. Total Air Content: 2-4 percent, determined in accordance with ASTM C173/C173M.
 4. Maximum Slump: 4 inches.
 5. Maximum Aggregate Size: 5/8 inch.

2.7 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
- B. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2 PREPARATION

- A. Verify that forms are clean and free of rust before applying release agent.
- B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in accordance with bonding agent manufacturer's instructions.
 - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
 - 2. Use latex bonding agent only for non-load-bearing applications.
- D. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.
- E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Notify Architect not less than 24 hours prior to commencement of placement operations.

- D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- G. Place concrete within the tolerances specified below:
 - 1. Dimensional tolerances for formed surfaces:
 - a. Variation from plumb:
 - 1) In the lines and surfaces of columns, piers, walls and in arises:
 - (a) In any 10 ft. of length.....1/4 in.
 - (b) Maximum for the entire length (length greater than 40'-0").....1 in.
 - 2) Exposed corner columns, control-joint grooves, and other conspicuous lines:
 - (a) In any 20 ft. of length.....1/4 in.
 - (b) Maximum for the entire length.....1/2 in.
 - b. Variation from the level or from the grades specified in the contract documents:
 - 1) In slab soffits, ceilings, beam soffits and in arises, measured before removal of supporting shores
 - (a) In any 10 ft. of length.....1/4 in.
 - (b) In any bay or in any 20 ft. of length.....3/8 in.
 - (c) Maximum for the entire length.....3/4 in.
 - 2) In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
 - (a) In any bay or in 20 ft. length.....1/4 in.
 - (b) Maximum for the entire length.....1/2 in.
 - c. Variation of the linear building lines from established position in plan and related position of columns, walls, and partitions:
 - 1) In any bay.....1/2 in.
 - 2) In any 20 ft. of length.....1/2 in.
 - 3) Maximum for the entire length.....1 in.
 - d. Variation in the sizes and location of sleeves, floor openings, and wall openings.....+1/4 in.
 - e. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls:
 - 1) Minus.....1/4 in.
 - 2) Plus.....1/2 in.
 - f. Footings*
 - 1) Variations in dimensions in plan:
 - (a) Minus.....1/4 in.
 - (b) Plus.....1/2 in.
 - (c) Misplacement or eccentricity:

- (1) 2 percent of the footing width in the direction of misplacement but not more than.....2 in.
- (d) Thickness:
 - (1) Decrease in specified thickness.....5%
 - (2) Increase in specified thickness.....No limit

- 2) Footing Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items.

3.4 SLAB JOINTING

- A. Locate joints as indicated on the drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

3.5 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
 - 1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
 - 2. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.
- D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 - 1. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.
- E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.6 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 - 1. Normal concrete: Not less than 7 days.
- C. Surfaces Not in Contact with Forms:

1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
2. Final Curing: Begin after initial curing but before surface is dry.
 - a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.
 - b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.7 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01-40-00 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- E. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.
- F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
- H. Slab Testing: Cooperate with manufacturer of specified moisture vapor reduction admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.

3.8 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.9 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION 03 30 00

SECTION 05 12 00
STRUCTURAL STEEL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Structural steel framing members, support members.
2. Base plates, shear stud connectors and expansion joint plates.
3. Grouting under base plates.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including Contractual Conditions and Divisions 1 Specification Sections, apply to this section.

1.03 REFERENCE STANDARDS

- A. AISC (MAN) - Steel Construction Manual; American Institute of Steel Construction, Inc.; 2011.
- B. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.; 2010.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- E. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.
- F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.
- H. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.
- I. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2014.
- J. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

- K. ASTM A514/A514M - Standard Specification for High-Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding; 2014.
- L. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a (Reapproved 2014).
- M. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric] ; 2007.
- N. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011 (Reapproved 2015).
- O. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.
- P. ASTM E94 - Standard Guide for Radiographic Examination; 2004 (Reapproved 2010).
- Q. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2013.
- R. ASTM E165/E165M - Standard Test Method for Liquid Penetrant Examination for General Industry; 2012.
- S. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2014.
- T. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.
- U. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2012.
- V. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2011 w/Errata.
- W. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.; 2011.
- X. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2009.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
 - 2. Connections not detailed.
 - 3. Indicate cambers and loads.
 - 4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.5 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC "Steel Construction Manual."
- B. Comply with Section 10 of AISC "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.
- C. Maintain one copy of each document on site.
- D. Fabricator: Company specializing in performing the work of this section with minimum 5 years of documented experience.
- E. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel (AC172).
- F. Erector: Company specializing in performing the work of this section with minimum 5 years of documented experience.
- G. Design connections not detailed on the drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

1.6 FIELD MEASUREMENTS

- A. Verify that all measurements are as shown on shop drawings and instructed by the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Angles and Plates: ASTM A36/A36M.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Rolled Steel Structural Shapes: ASTM A992/A992M.
- D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.
- E. Steel Plate: ASTM A514/A514M.
- F. Pipe: ASTM A53/A53M, Grade B, Finish black.
- G. Shear Stud Connectors: Made from ASTM A 108 Grade 1015 bars.
- H. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A galvanized to ASTM A 153/A 153M, Class C.
- I. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325 or ASTM A325M, Type 1, medium carbon, galvanized, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436 washers.

- J. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- K. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107M and capable of developing a minimum compressive strength of 7,000 psi at 28 days.
- L. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
- M. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.2 FABRICATION

- A. Shop fabricate to greatest extent possible.
- B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- C. Develop required camber for members.
- D. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- E. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- F. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.3 FINISH

- A. Prepare structural component surfaces in accordance with SSPC SP 3, "Power Tool Cleaning".
- B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

2.4 SOURCE QUALITY CONTROL

- A. Provide shop testing and analysis of structural steel.
- B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.
- C. Welded Connections: Visually inspect all shop-welded connections and test at least 10 percent of welds using one of the following:
 - 1. Radiographic testing performed in accordance with ASTM E94.
 - 2. Ultrasonic testing performed in accordance with ASTM E164.
 - 3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
 - 4. Magnetic particle inspection performed in accordance with ASTM E709.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.2 ERECTION

- A. Erect structural steel in compliance with AISC "Code of Standard Practice for Steel Buildings and Bridges".
- B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Field weld components indicated on shop drawings.
- D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC "Specification for Structural Joints Using High-Strength Bolts".
- E. Do not field cut or alter structural members without approval of Architect.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- G. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.

2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
- H. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.
- I. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- J. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- K. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.3 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.4 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

3.5 FIELD QUALITY CONTROL

- A. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.
- B. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:
 - 1. Radiographic testing performed in accordance with ASTM E94.
 - 2. Ultrasonic testing performed in accordance with ASTM E164.
 - 3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
 - 4. Magnetic particle inspection performed in accordance with ASTM E709.

3.6 PAINTING

- A. Prime coat un-primed, bare structural steel and fittings, except galvanized items, which will not be enclosed or concealed in the finished work.
- B. Prepare surfaces by removing loose rust, mill scale, spatter, slag and flux deposits.
- C. After erection, clean spots and surfaces where paint has been removed, damaged, or burned off. Clean field bolts and other field connections not concealed in finished work. Remove dirt, oil and grease.
- D. Spot prime, filling joints and corners and covering all surfaces with a smooth unbroken film of a minimum of 1.5 mils thickness.

END OF SECTION 05 12 00

SECTION 05 52 13 PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum railings.

1.2 COORDINATION

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

1.3 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of mechanically connected railings.
2. Fasteners.
3. Post-installed anchors.
4. Handrail brackets.
5. Metal finishes.

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

- C. Samples for Initial Selection: For products involving selection of color, texture, or design[, **including mechanical finishes**].

- D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

- a. Show method of [**connecting**] [**and**] [**finishing**] members at intersections.

- E. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[delegated design professional engineer]** **[testing agency]**.
- B. Welding certificates.
- C. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.
- D. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of **50 lbf/ ft.** applied in any direction.
 - b. Concentrated load of **200 lbf** applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:

- a. Concentrated load of **50 lbf** applied horizontally on an area of **1 sq. ft.**
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: [**120 deg F, ambient; 180 deg F, material surfaces**].

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
1. Provide type of bracket with [**predrilled hole for exposed bolt anchorage**] and that provides **1-1/2-inch** clearance from inside face of handrail to finished wall surface.

2.3 ALUMINUM RAILINGS

- 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. [**Hollaender Mfg. Co.**]
 2. [**Julius Blum & Co., Inc.**]
 3. [**Kane Innovations, Inc.**]
 4. [**Kee Safety, Inc.**]
 5. [**Moultrie Rail Systems**]
 6. [**Superior Aluminum Products, Inc**]
 7. [**Tubular Specialties Manufacturing, Inc.**]
- B. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- C. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- D. Extruded Bars and Tubing: **ASTM B221**, Alloy 6063-T5/T52.
- E. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, Alloy 6063-T6.
1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
- F. Drawn Seamless Tubing: ASTM B210/B210M, Alloy 6063-T832.

- G. Plate and Sheet: **ASTM B209**, Alloy 6061-T6.
- H. Die and Hand Forgings: **ASTM B247**, Alloy 6061-T6.
- I. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.4 FASTENERS

A. Fastener Materials:

- 1. Aluminum Railing Components: [**Type 316**] stainless steel fasteners.
- 2. Finish exposed fasteners to match appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction [**and capable of withstanding design loads**].

C. Fasteners for Interconnecting Railing Components:

- 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
- 2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
- 3. Provide [**tamper-resistant**] flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193[**or ICC-ES AC308**].

- 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
- 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy [**Group 1**]stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Brackets: [**Cast aluminum,**] or [**Cast stainless steel,**] center of handrail [**2-1/2 inches**] from [**face of railing**] or [**wall**].

B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

- 1. For [**aluminum railings**, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

C. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM

D1187/D1187M.

- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- E. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: **[At exterior locations] [and] [where indicated on Drawings]**, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage [, **but not less than that required to support structural loads**].
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately **1/32 inch** unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water.
 - 1. Provide weep holes where water may accumulate.
 - 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with **[welded] [or] [nonwelded]** connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and

- corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for **[Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay]**.
- I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- J. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- 1. Fabricate splice joints for field connection, using an epoxy structural adhesive, if this is manufacturer's standard splicing method.
- K. Form changes in direction as follows:
- 1. As detailed.
 - 2. **[By bending] [or] [by inserting prefabricated elbow fittings]**.
- L. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- M. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is **1/4 inch** or less.
- O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
- 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
- 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 - 2. Coordinate anchorage devices with supporting structure.
- Q. For railing posts set in concrete, provide stainless steel sleeves not less than **6 inches** long with inside dimensions not less than **1/2 inch** greater than outside dimensions of post, with metal plate forming bottom closure.

- R. For removable railing posts, fabricate slip-fit sockets from stainless steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.
 - 1. Provide socket covers designed and fabricated to resist being dislodged.
 - 2. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
- S. Toe Boards: Provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 ALUMINUM FINISHES

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
 - 1. Fit exposed connections together to form tight, hairline joints.
 - 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 - 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 - 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 5. Set posts plumb within a tolerance of **1/16 inch in 3 feet**.
 - 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed **1/4 inch in 12 feet**.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending **2 inches** beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within **6 inches** of post.

3.4 ANCHORING POSTS

- A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with **[nonshrink, nonmetallic grout] [or] [anchoring cement]**, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than **5 inches** deep and **3/4 inch** larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with **[nonshrink, nonmetallic grout] [or] [anchoring cement]**, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, **[welded to post after placing anchoring material] [attached to post with setscrews]**.
- D. Leave anchorage joint exposed with **[1/8-inch buildup, sloped away from post] [anchoring material flush with adjacent surface]**.
- E. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For aluminum railings, attach posts as indicated, using fittings designed and engineered for this purpose.
- F. Install removable railing sections, where indicated, in slip-fit stainless-steel sockets cast in concrete.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with [**sleeves concealed within**] [**flanges connected to**] [**brackets on underside of rails connected to**] railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and [**welded to railing ends**] [**or**] [**connected to railing ends, using nonwelded connections**].
- C. Attach handrails to walls with wall brackets [, **except where end flanges are used**]. Provide brackets with [**1-1/2-inch**] clearance from inside face of handrail and finished wall surface.
 - 1. Use type of bracket with [**predrilled hole for exposed bolt anchorage**].
 - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. Secure wall brackets [**and railing end flanges**] to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 4. For steel-framed partitions, use hanger or lag bolts set into [**fire-retardant-treated**] **wood** backing between studs. Coordinate with stud installation to locate backing members.
- E. Install railing gates level, plumb, and secure for full opening without interference.
 - 1. Attach hardware using tamper-resistant or concealed means.
 - 2. Adjust hardware for smooth operation.

3.6 REPAIR

3.7 CLEANING

- A. Clean [**aluminum**] by washing thoroughly with clean water and soap and rinsing with clean water.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION 05 52 13

SECTION 05 73 00

DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum decorative railings with stainless steel cable infill

1.2 COORDINATION AND SCHEDULING

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

1.3 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of decorative metal railings assembled from standard components.
2. Stainless steel cable and cable fittings.
3. Fasteners.
4. Post-installed anchors.

- B. Shop Drawings: Include plans, elevations, sections, and attachment details.

- C. Samples for Initial Selection: For products involving selection of color, texture, or design [, **including mechanical finishes**].

- D. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 DELIVERY, STORAGE, AND HANDLING

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

1.5 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of **50 lbf/ft.** applied in any direction.
 - b. Concentrated load of **200 lbf** applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of **50 lbf** applied horizontally on an area of **1 sq. ft.**
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS, GENERAL

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

2.3 ALUMINUM DECORATIVE RAILINGS WITH STAINLESS STEEL CABLE

- A. Basis of Design Product: Subject to compliance with requirements, provide Seco South, Inc.: Aluminum Powder Coated Stainless Steel Cable Railing System AP1-2000
 - 1. System AP1-2000 Aluminum Cable Railing System:
 - 2. Balusters: 2 inch square aluminum post component system.
 - 3. Handrail: 3X1 inches in oval aluminum.
 - 4. Baluster and Handrail: Aluminum – Marine Grade Powder coat in color to be selected by architect from entire product range.
 - 5. Cable Infill: 1 x 19, 1/8-inch 316 stainless steel

6. Cable Infill Fittings: 316 stainless steel, Adjustable stud tensioners.
- B. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
- C. Extruded Bars and Shapes, Including Extruded Tube: **ASTM B221**, Alloy 6063-T5/T52.
- D. Extruded Structural Pipe and Round Tube: ASTM B429/B429M, Alloy 6063-T6.
 1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
- E. Drawn Seamless Tube: ASTM B210/B210M, Alloy 6063-T832.
- F. Plate and Sheet: **ASTM B209**, [Alloy 5005-H32] [Alloy 6061-T6].
- G. Die and Hand Forgings: **ASTM B247**, Alloy 6061-T6.

2.4 FASTENERS

- A. Fastener Materials:
 1. Aluminum Railing Components: [Type 316] stainless steel fasteners.
 2. Stainless Steel Railing Components: [Type 316] stainless steel fasteners.
 3. Dissimilar Metal Railing Components: [Type 316] stainless steel fasteners.
 4. Finish exposed fasteners to match appearance, including color and texture, of railings.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction [**and capable of withstanding design loads**].
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless [**exposed fasteners are the standard fastening method for railings indicated**].
 1. Provide [square or hex socket] flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 [**or ICC-ES AC308**].
 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy [**Group 1**] stainless steel bolts, ASTM F593 and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

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

1. For [aluminum] [and] [stainless steel] railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- C. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 1. Water-Resistant Product: [At exterior locations] provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

- A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage [, **but not less than that required to support structural loads**].
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 1. Clearly mark units for reassembly and coordinated installation.
 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water.
 1. Provide weep holes where water may accumulate.
 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with [**welded**] connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 1. Use materials and methods that minimize distortion and develop strength

- and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove flux immediately.
 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.
- I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
 - J. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
 - K. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
 - L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is **1/4 inch** or less.
 - M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry Work.
 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 2. Coordinate anchorage devices with supporting structure.
 - N. For railing posts set in concrete, provide stainless steel sleeves not less than **6 inches** long with inside dimensions not less than **1/2 inch** greater than outside dimensions of post, with metal plate forming bottom closure.
 - O. Stainless Steel Cable Guard Infill: Fabricate cable guard infill assemblies in the shop to field-measured dimensions with fittings machine swaged.
 1. Minimize amount of turnbuckle take-up used for dimensional adjustment, so maximum amount is available for tensioning cable.
 2. Tag cable assemblies and fittings to identify installation locations and orientations for coordinated installation.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are

within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Marine Grade, AAMA 2603 except with a minimum dry film thickness of **1.5 mils**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

- 1. Color and Gloss: [As selected by Architect from manufacturer's full range]

PART 3 - EXECUTION

3.1 EXAMINATION

3.2 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
 - 1. Fit exposed connections together to form tight, hairline joints.
 - 2. Install railings level, plumb, square, true to line, without distortion, warp, or rack.
 - 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 - 4. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat concealed surfaces of [aluminum] that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending **2 inches** beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within **6 inches** of post.

3.4 ANCHORING POSTS

- A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with [**nonshrink, nonmetallic grout**] [**or**] [**anchoring cement**], mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than **5 inches** deep and **3/4 inch** larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with [**nonshrink, nonmetallic grout**] [**or**] [**anchoring cement**], mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Leave anchorage joint exposed with [**1/8-inch buildup, sloped away from post**].
- D. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For aluminum railings, attach posts as indicated, using fittings designed and engineered for this purpose.
- E. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with [**sleeves concealed within**] railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and [**welded to railing ends**] [**or**] [**connected to railing ends, using nonwelded connections**].

C. Secure wall brackets [**and railing end flanges**] to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

3.6 CLEANING

A. Clean [**aluminum**] [**and**] [**stainless steel**] by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION 05 73 00

SECTION 06 16 00
SHEATHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Wall sheathing.

1.3 SUBMITTALS

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

1.4 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 WALL SHEATHING

- 1. Wall Sheathing: ASTM C 1177/1177M.
 - a. Any PS 2 type rated Structural I Sheathing.
 - b. Bond Classification: Exterior
 - c. Span Rating: 24
 - d. Performance Category: 5/8 PERF. CAT.
- 2. Thickness: 5/8-inch.
- 3. Size: 48 by 96 inches.

2.2 2.2 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
- B. For wall sheathing, provide Type 316 Stainless Steel fasteners.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. ICC-ES evaluation report for fastener.
- D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- E. Coordinate wall 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.

END OF SECTION 06 16 00

SECTION 06 17 53
SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Shop fabricated wood trusses for roof framing.
2. Bridging, bracing, and anchorage.
3. Preservative treatment of wood.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Material requirements for blocking, bridging, plates, and miscellaneous framing.

1.3 REFERENCE STANDARDS

- A. ANSI/TPI 1 - National Design Standard for Metal-Plate-Connected Wood Truss Construction; 2014.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- D. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2017).
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- F. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.
- G. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber; 2000.
- H. SPIB (GR) - Grading Rules; 2014.
- I. TPI BCSI 1 - Building Component Safety Information Booklet: The Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses; 2015.
- J. TPI DSB-89 - Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses; 1989.
- K. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; 2015.
- L. WWPA G-5 - Western Lumber Grading Rules; 2017.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on plate connectors, bearing plates, and metal bracing components.
- B. Shop Drawings: Show truss configurations, sizes, spacing, size and type of plate connectors, cambers, framed openings, bearing and anchor details, and bridging and bracing.
 - 1. Include identification of engineering software used for design.
 - 2. Provide shop drawings stamped or sealed by design engineer.
 - 3. Submit design calculations.
- C. Designer's Qualification Statement.
- D. Fabricator's Qualification Statement.

1.5 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design by or under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Florida.
- B. Fabricator Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle and erect trusses in accordance with TPI BCSI 1.
- B. Store trusses in vertical position resting on bearing ends.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Truss Plate Connectors:
 - 1. Alpine, an ITW Company: www.alpineitw.com/#sle.
- B. Truss Fabricators:
 - 1. RedBuilt LLC; Open Web Trusses: www.redbuilt.com/#sle.
 - 2. Alpine: www.alpineitw.com.
 - 3. Substitutions: As approved by Architect or Engineer.

2.2 TRUSSES

- A. Wood Trusses: Designed and fabricated in accordance with ANSI/TPI 1 and TPI DSB-89 to achieve structural requirements indicated.
 - 1. Species and Grade: Southern Pine, SPIB (GR) Grade.

2. Connectors: Steel plate.
3. Structural Design: Comply with applicable code for structural loading criteria.
4. Design Roof Live and Dead Load: As indicated on Drawings.
5. Roof Deflection: 1/240, maximum.

2.3 MATERIALS

- A. Lumber:
 1. Moisture Content: Between 7 and 9 percent.
 2. Lumber fabricated from old growth timber is not permitted.
- B. Steel Connectors: Hot-dipped galvanized steel sheet, ASTM A653/A653M.
- C. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

2.4 ACCESSORIES

- A. Wood Blocking, Bridging, Plates, and Miscellaneous Framing: Softwood lumber, any species; Douglas Fir; Spruce/Pine/Fir.
- B. Fasteners: Hot-dip galvanized steel, type to suit application.
- C. Bearing Plates: Hot-dip galvanized steel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated on shop drawings.
- B. Verify that supports and openings are ready to receive trusses.

3.2 PREPARATION

- A. Coordinate placement of support items.

3.3 ERECTION

- A. Install trusses in accordance with manufacturer's instructions and TPI DSB-89 and TPI BCSI 1.
- B. Set members level and plumb, in correct position.
- C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.
- D. Do not field cut or alter structural members without approval of Architect.
- E. Install permanent bridging and bracing.
- F. Install headers and supports to frame openings required.
- G. Coordinate placement of decking with work of this section.
- H. After erection, touch-up galvanized surfaces with zinc primer.

3.4 SITE APPLIED WOOD TREATMENT

- A. Treat all site-sawn cuts of pressure-treated wood using same type of treatment (i.e. preservative or fire-retardant).
- B. Apply preservative treatment to non-pressure-treated wood wherever it will come into contact with cementitious materials, roofing, asphaltic materials, or metals.
- C. Apply fire-retardant treatment to all exposed surfaces after erection.
- D. Apply treatment in accordance with manufacturer's instructions.
- E. Allow field-applied treatment to dry prior to erecting members.

3.5 TOLERANCES

- A. Framing Members: 1/2 inch maximum, from true position.

END OF SECTION 06 17 53

SECTION 07 21 00
THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Glass-fiber blanket insulation.
 2. Glass-fiber board insulation.

1.2 ACTION SUBMITTALS

- A. Product Data:
1. Glass-fiber blanket insulation.
 2. Glass-fiber board insulation.

1.3 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than **[25 and 450] [75 and 450] [200 and 450]** when tested in accordance with ASTM E84.
1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.
- B. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- C. Labeling: Provide identification of mark indicating R-value of each piece of insulation **12 inches** and wider in width.
- D. Thermal-Resistance Value (R-Value): **[R-value as indicated on Drawings]** in accordance with ASTM C518.

2.2 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket Insulation, Kraft Faced: ASTM C665, Type II (nonreflective faced),

Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

1. Basis-of-Design Product: Subject to compliance with requirements, provide Owens Corning: PINK NEXT GEN™ FIBERGLAS™ INSULATION or comparable product by one of the following:
 - a. [CertainTeed; SAINT-GOBAIN]
 - b. [Johns Manville; a Berkshire Hathaway company]
 - c. [Knauf Insulation]

2.3 GLASS-FIBER BOARD INSULATION

- A. Glass-Fiber Board Insulation, Unfaced: ASTM C612, Type IA; unfaced[, **passing ASTM E136 for combustion characteristics**].

1. Basis-of-Design Product: Subject to compliance with requirements, provide Owens Corning: FIBERGLA 703 SERIES INSULATION BOARD or comparable product by one of the following:

- a. [CertainTeed; SAINT-GOBAIN]
- b. [Johns Manville; a Berkshire Hathaway company]
- c. [Knauf Insulation]

2. Nominal Density [**3 lb./cu. ft.**].

2.4 INSULATION FASTENERS

- A. Insulation-Retaining Washers: Self-locking washers formed from **0.016-inch-** 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** square or in diameter.

1. Manufacturers: Subject to compliance with requirements [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

- a. [AGM Industries, Inc]
- b. [Gemco]

2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:

- a. Ceiling plenums.
- b. Attic spaces.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing

projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

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

3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain **3-inch** clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For metal-framed wall cavities where cavity heights exceed **96 inches**, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - 6. For wood-framed construction, install blankets in accordance with ASTM C1320 and as follows:
 - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum

- volume equaling a density of approximately **2.5 lb/cu. ft.**
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.
- C. Spray-Applied Cellulosic Insulation: Apply spray-applied insulation according to manufacturer's written instructions.
1. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked.
 2. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.
- 3.4 PROTECTION
- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
 - B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 41 13.16
STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vertical-rib, seamed-joint, standing-seam metal roof panels.
2. Underlayment.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For standing-seam metal roof panels. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

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

C. Samples for Initial Selection: Manufacturer's standard color charts, showing full range of available colors for each type of exposed finish.

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

1.3 INFORMATIONAL SUBMITTALS

A. Florida Product Approval or Miami Dade N.O.A

B. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels.

1.5 QUALITY ASSURANCE

A. Roof Installer Qualifications: Minimum of 10 years' experience installing metal standing seam roof systems on commercial construction projects.

1.6 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.

1.7 FIELD CONDITIONS

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

1.8 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.

1.9 WARRANTY

- A. Special Warranty: 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 metal and other materials beyond normal weathering.
 - 2. Warranty Period: <2> years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: [20] years from date of Substantial Completion.
- C. Special Weathertightness Warranty: 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. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E1592:
1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: [As indicated on Drawings].
 3. Deflection Limits: For wind loads, no greater than [1/240] of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested in accordance with ASTM E1680[or ASTM E283/E283M] at the following test-pressure difference:
1. Test-Pressure Difference: [6.24 lbf/sq. ft.].
- C. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E1646[or ASTM E331] at the following test-pressure difference:
1. Test-Pressure Difference: [6.24 lbf/sq. ft.].
- D. Watertightness: No water penetration when tested in accordance with ASTM E2140 for hydrostatic-head resistance.
- E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
1. Uplift Rating: [UL 90].
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: [120 deg F, ambient; 180 deg F, material surfaces]

G. Energy Performance:

1. Provide roof panels in accordance with one of the following when tested in accordance with CRRC-1:
 - a. Three-year, aged solar reflectance of not less than [0.55] and emissivity of not less than [0.75] .
 - b. Three-year, aged Solar Reflectance Index (SRI) of not less than [64] when calculated in accordance with ASTM E1980.

2.2 STANDING-SEAM METAL ROOF PANELS, GENERAL

- A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
1. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1637.

2.3 VERTICAL-RIB, SEAMED-JOINT, STANDING-SEAM METAL ROOF PANELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide MBCI LokSeam 1.75" Mechanical Seam Metal Roof Panels or comparable product by one of the following:
1. Advanced Building Products Inc.
 2. ATAS International, Inc.
 3. Berridge Manufacturing Company
 4. CENTRIA, a Nucor Brand
 5. Fabral; a brand of Flack Global Metals
 6. Everlast Metals
 7. McElroy Metal, Inc
 8. PAC-CLAD; Petersen; a Carlisle company
- B. Panels: Formed with vertical ribs at panel edges; 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. Structural Support: Over solid deck.
 2. Material: Aluminum.
 3. Panel Thickness: Minimum 0.040 inch.
 4. Seam Type: Manufacturer's standard.
 5. Panel Profile: Intermediate stiffening ribs symmetrically spaced between ribs.
 6. Panel Coverage: As required to meet Wind Loading and Florida Product Approval or Miami Dade N.O.A.
 7. Panel Height: 1.75 inches.
 8. Clips: Two piece, floating, designed to accommodate thermal movement.
 - a. Stainless Steel Clips: 0.0625-inch- thick, stainless-steel sheet.

- b. Clip Spacing: As indicated on approved Shop Drawings.

2.4 UNDERLAYMENT

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide GCP Ice & Water Shield HT or comparable product by one of the following:
 - a. [ATAS International, Inc.]
 - b. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
 - c. [Henry Company; a Carlisle company]
 - d. [Owens Corning]
 - e. [Polyglass U.S.A., Inc.]
 - f. [Protecto Wrap Company]
 - g. [SDP Advanced Polymer Products Inc.]
- B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.5 PANEL MATERIALS

- A. Aluminum Sheet: Coil-coated sheet, ASTM B209/B209M, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - 1. Thickness: [0.040 inch].
 - 2. Surface: [Smooth, flat] finish.

2.6 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum **1-inch**-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed

openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

- C. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, of size and metal thickness in accordance with manufacturer's recommendations. Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match [roof fascia and rake trim].
- D. Downspouts: Formed from same material as roof panels. Fabricate in 10 ft. long sections, complete with formed elbows and offsets, of size and metal thickness in accordance with manufacturer's recommendations. Finish downspouts to match gutters.
- E. Roof Curbs: Fabricated from same material as roof panels, [0.048-inch] 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- 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- thick, rigid insulation.
- F. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
 - 2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.7 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate in accordance with equipment manufacturer's written instructions and to comply with details shown.

- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for other than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with manufacturer's recommendations.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not permitted on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by metal panel manufacturer for application, but not less than thickness of metal being secured.

2.8 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.
- C. Aluminum Panels and Accessories:
 - 1. Three-Coat Fluoropolymer: AAMA 2605. 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 [for seacoast and severe environments].

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 in accordance with ASTM C754 and metal panel manufacturer's written installation instructions.

3.3 INSTALLATION OF ROOF INSULATION

- A. Reference Section 07 21 00 THERMAL INSULATION.

3.4 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated [below], wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
 - 1. Apply over the entire roof surface.
- B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.
- C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

3.5 INSTALLATION OF STANDING-SEAM METAL ROOF PANELS

- A. Install metal panels in accordance with manufacturer's written installation instructions and approved Shop Drawings in orientation, sizes, and locations indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal panels.
 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
 2. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
 3. Copper Panels: Use copper, stainless steel, or hardware-bronze fasteners.
 4. Stainless Steel Panels: Use stainless steel fasteners.
- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners in accordance with manufacturers' written installation instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
1. Install clips to supports with self-tapping fasteners.
 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely

- engaged.
5. Watertight Installation:
- a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommended in writing by manufacturer as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.
- 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 and manufacturer's written installation instructions. 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 ft. with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
1. 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 and Conduit Penetrations: Fasten and seal to metal roof panels as recommended by manufacturer.

3.6 ERECTION TOLERANCES

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

3.7 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.

3.8 CLEANING AND PROTECTION

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

END OF SECTION 07 41 13.16

SECTION 07 46 46
FIBER-CEMENT SIDING AND SOFFITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fiber-cement siding.
 - 2. Fiber-cement soffit.

1.2 COORDINATION

- A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Fiber-cement siding.
 - 2. Fiber-cement soffit.
- B. Product Data Submittals: For each type of fiber-cement [siding] [and] [soffit]. [Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.]
- C. Samples for Initial Selection: For fiber-cement [siding] [and] [soffit] including related accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with labels intact until time of use.
- B. Store materials on elevated platforms, under cover, and in a dry location.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking and deforming.
 - b. Deterioration of materials beyond normal weathering.
 - 2. Warranty Period: [25] years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SIDING

- A. Fiber-Cement Siding: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested in accordance with ASTM E136; with a flame-spread index of 25 or less when tested in accordance with ASTM E84.
 - 1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [American Fiber Cement Corporation]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [GAF]
 - d. [James Hardie Building Products, Inc.]
 - e. [Nichiha USA, Inc.]
- B. Labeling: Provide fiber-cement siding that is tested and labeled in accordance with ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- C. Nominal Thickness: Not less than 5/16 inch.
- D. Horizontal Pattern: Boards [7-1/4 to 7-1/2 inches] wide in [plain] style.
 - 1. Texture: [Wood grain] .
- E. Panel Texture: 48-inch- wide sheets with [smooth] texture.
- F. Factory Priming: Manufacturer's standard acrylic primer.

2.3 FIBER-CEMENT SOFFIT

- A. Fiber-Cement Soffit: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested in accordance with ASTM E136; with a flame-spread index of 25 or less when tested in accordance with ASTM E84.
 - 1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [CertainTeed; SAINT-GOBAIN]
 - b. [James Hardie Building Products, Inc.]

c. [Nichiha USA, Inc.]

- B. Nominal Thickness: Not less than 5/16 inch.
- C. Pattern: [12-inch-] [16-inch-] [24-inch-] wide sheets with [smooth] texture.
- D. Ventilation: Provide [unperforated] soffit [unless otherwise indicated].
- E. Factory Priming: Manufacturer's standard acrylic primer.

2.4 ACCESSORIES

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
 - 1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.
- B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:
 - 1. Corner posts.
 - 2. Door and window casings.
 - 3. Fasciae.
 - 4. Moldings and trim.
- C. Flashing: Provide [stainless steel] flashing complying with Section 07 62 00 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.
- D. Fasteners:
 - 1. For fastening to wood, use [ribbed bugle-head screws] of sufficient length to penetrate a minimum of 1 inch into substrate.
 - 2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
 - 3. For fastening fiber cement, use [stainless steel] fasteners.
- E. Insect Screening for Soffit Vents: [Stainless steel, 18-by-18 mesh].
- F.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement [siding] [and] [soffit] and related accessories.

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

3.2 PREPARATION

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

3.3 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - 1. Do not install damaged components.
 - 2. Install fasteners no more than [24 inches] o.c.
- B. Install joint sealants as specified in Section 07 92 00 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 46

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Latex joint sealants.

1.2 QUALITY ASSURANCE

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

1.3 FIELD CONDITIONS

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

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

1.4 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: [**Two**] years from date of Substantial Completion.

- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: [**Five**] years from date of Substantial Completion.

- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant

- manufacturer's written specifications for sealant elongation and compression.
- 2. Disintegration of joint substrates from causes exceeding design specifications.
- 3. Mechanical damage caused by individuals, tools, or other outside agents.
- 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain joint sealants from single manufacturer [for each sealant type].

2.2 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].

2.3 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [GE Construction Sealants; Momentive Performance Materials Inc.]
 - b. [Pecora Corporation]
 - c. [Permathane; a Holcim brand]
 - d. [Polymeric Systems, Inc]
 - e. [Sherwin-Williams Company (The)]
 - f. [Sika Corporation - Building Components]
 - g. [The Dow Chemical Company]

2.4 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, [available

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

- a. [Pecora Corporation]
- b. [Permathane; a Holcim brand]
- c. [Polymeric Systems, Inc]
- d. [PPG Paints; PPG Industries, Inc.]
- e. [Sherwin-Williams Company (The)]
- f. [Sika Corporation - Building Components]
- g. [Tremco Incorporated]

2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [GE Construction Sealants; Momentive Performance Materials Inc.]
 - b. [Pecora Corporation]
 - c. [PPG Paints; PPG Industries, Inc.]
 - d. [Sika Corporation - Building Components]
 - e. [Soudal Accumetric]
 - f. [The Dow Chemical Company]
 - g. [Tremco Incorporated]

2.6 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
 1. Manufacturers: Subject to compliance with requirements [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Pecora Corporation]
 - b. [PPG Paints; PPG Industries, Inc.]
 - c. [Sherwin-Williams Company (The)]
 - d. [Tremco Incorporated]

2.7 JOINT-SEALANT BACKING

- A. Sealant Backing Material: Non-staining; 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.

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

- a. [Construction Foam Products; a division of Nomaco, Inc.]
- b. [Master Builders Solutions; brand of MBCC Group]

B. Cylindrical Sealant Backings: ASTM C1330, [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.

2.8 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: Non-staining, 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.
 - d. Exterior insulation and finish systems.
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 C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with 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 in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.
 4. Provide flush joint profile at [locations indicated on Drawings] in accordance with Figure 8B in ASTM C1193.
 5. Provide recessed joint configuration of recess depth and at [locations indicated on Drawings] in accordance with Figure 8C in ASTM C1193.
 - 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.

END OF SECTION 07 92 00

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core five-ply flush wood veneer-faced doors and transom panels for transparent finish.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Solid-core five-ply flush wood veneer-faced doors and transom panels for transparent finish.

B. Product Data Submittals: For each product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Door frame construction.
6. Factory-machining criteria.
7. Factory- **[finishing]** specifications.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door **[and frame]** location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Dimensions and locations of blocking for hardware attachment.
5. Dimensions and locations of mortises and holes for hardware.
6. Clearances and undercuts.
7. Requirements for veneer matching.

D. Samples for Initial Selection: For **[factory-finished doors]**.

1.3 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]** **[cardboard**

cartons and wrap bundles of doors in plastic sheeting].

- C. Mark each door on [**top and**] bottom rail with opening number used on Shop Drawings.

1.4 FIELD CONDITIONS

A. Environmental Limitations:

1. 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 and relative humidity at levels designed for building occupants for the remainder of construction period.
2. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between **60 and 90 deg F** and relative humidity between [**25 and 55**] percent during remainder of construction period.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors[**and frames**] that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than **1/4 inch** in a **42-by-84-inch** section.
 - c. Telegraphing of core construction in face veneers exceeding **0.01 inch in a 3-inch** span.
2. Warranty also includes installation and finishing that may be required due to
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS AND FRAMES, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with [**AWI/AWMA/WI's "Architectural Woodwork Standards."**]

1. Provide [**labels**] [**and**] [**certificates**] from [**AWI**] certification program indicating that doors [**and frames**] comply with requirements of grades specified.
2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to

those of the referenced quality standard.

2.3 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS AND TRANSOM PANELS FOR TRANSPARENT FINISH

A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:

1. Manufacturers: Subject to compliance with requirements, **[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Masonite Architectural]**
 - b. **[Oshkosh Door Company]**
 - c. **[VT Industries, Inc.]**
2. Performance Grade: ANSI/WDMA I.S. 1A **[Extra Heavy Duty]**.
3. Architectural Woodwork Standards Quality Grade: **[Premium]**.
4. Faces: Single-plywood veneer not less than **1/50 inch** thick.
 - a. Species: **[Select white birch]** or **[Select white maple]**.
 - b. Cut: **[Plain sliced (flat sliced)]**.
 - c. Match between Veneer Leaves: **[Slip]**match.
 - d. Assembly of Veneer Leaves on Door Faces: **[Center-balance]** match.
 - e. Pair and Set Match: Provide for doors hung in same opening **[or separated only by mullions]**.
 - f. Room Match:
 - 1) Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by **[20 feet]** or more.
 - 2) Provide door faces of compatible color and grain within each separate room or area of building.
 - g. Transom Match: **[End match]**.
5. Exposed Vertical and Top Edges: **[Applied wood edges of same species as faces and covering edges of crossbands - Architectural Woodwork Standards edge Type D]**.
6. Core for Non-Fire-Rated Doors:
 - a. Either glued wood stave or WDMA I.S. 10 structural composite lumber.
7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.

2.5 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 2. Finish faces, all four edges, edges of cutouts, and mortises.
 3. Stains and fillers may be omitted on[**top and**] bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Factory finish doors that are indicated on Drawings to receive transparent finish.
- D. Factory finish doors where indicated in schedules or on Drawings as factory finished.
- E. Transparent Finish:
 1. Architectural Woodwork Standards Grade: [**Premium**].
 - a. System-11, Polyurethane, Catalyzed.
 2. Staining:[**As selected by Architect from manufacturer's full range**].
 3. Sheen: [**Semigloss**].

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see [**Section 08 71 00 "Door Hardware."**]
- B. Install doors[**and frames**] to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

- C. Install frames level, plumb, true, and straight.
 - 1. Shim as required with concealed shims. Install level and plumb to a tolerance of **1/8 inch in 96 inches**.
 - 2. Anchor frames to anchors or blocking built in or directly attached to substrates.
 - a. Secure with countersunk, concealed fasteners and blind nailing.
 - b. Use fine finishing nails [**or finishing screws**] for exposed fastening, countersunk and filled flush with woodwork.
 - 1) For factory-finished items, use filler matching finish of items being installed.

- D. Job-Fitted Doors:
 - 1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
 - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
 - 2. Machine doors for hardware.
 - 3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 4. Clearances:
 - a. Provide **1/8 inch** at heads, jambs, and between pairs of doors.
 - b. Provide **1/8 inch** from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
 - c. Where threshold is shown or scheduled, provide **1/4 inch** from bottom of door to top of threshold unless otherwise indicated.
 - 5. Bevel non-fire-rated doors **1/8 inch in 2 inches** at lock and hinge edges.

- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

- A. Inspections:
 - 1. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

- B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

- C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 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 08 14 16

SECTION 08 16 13
FRP DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior FRP doors and frames.
2. Exterior FRP doors and frames.

1.2 DEFINITIONS

A. FRP is defined as "Fiberglass Reinforced Polyester"

1.3 COORDINATION

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

1.4 ACTION SUBMITTALS

A. Product Data:

1. Interior FRP doors and frames.
2. Exterior FRP doors and frames.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, core descriptions, and finishes.

C. Sustainable Design Submittals:

D. 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.

- E. Samples for Initial Selection: For FRP doors and frames with factory-applied color finishes.
- F. Product Schedule: For FRP 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Florida Product Approval: For each type provide a current Florida Product Approval and/or Miami Dade N.O.A.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver FRP doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
1. Provide additional protection to prevent damage to factory-finished units.
- B. Store FRP doors and frames vertically under cover at Project site with head up. Place on minimum **4-inch** high wood blocking. Provide minimum **1/4-inch** space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 FRP DOORS AND FRAMES

- A. Manufacturers: Basis of Design to be by Tiger Door, tigerdoor.com, 1-888-891-4416
1. Heavy Duty FRP Door and Frame
 2. Extreme Duty FRP Hurricane Doors (where required by location wind loads)

2.2 INTERIOR FRP DOORS AND FRAMES

- A. Construct FRP doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty FRP Doors and Frames: at all interior locations as indicated on drawings.

1. Design: FRP doors shall be of seamless press-molded construction.
2. Stiles & Rails: A high modulus pultruded FRP square or rectangular tube subframe is to be provided within the door.
3. Core: For maximum rigidity and compressive strength a triangular shaped 3/8" cell phenolic resin impregnated kraft paper honeycomb core shall be used.
4. Internal Reinforcement: High-modulus pultruded tubular FRP, high density polymer compression blocks, or plastic compression blocking at all hardware locations and corner locations.
5. Faces: Door faces shall utilize a chemical resistant thermosetting polyester resin system with fiber reinforcing layers.
6. Finish: The exposed FRP door faces shall have a 3-4 mils (wet) factory applied two-part aliphatic polyurethane full cured coating of industrial urethane.
7. Astragals: All pairs of doors shall be furnished with an astragal from the door manufacturer made of the same pultruded FRP material as the door stile, rail and edges.
8. Lites: Glass per job specification shall be factory furnished, glazed and installed.
9. Louvers: Fiberglass inverted V blade privacy or flat blade louvers shall be factory furnished and installed.

2.3 EXTERIOR FRP 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: at all exterior locations as indicated on drawings or as required by wind loading.
 1. Design: FRP doors shall be of seamless press-molded construction.
 2. Stiles & Rails: A high modulus pultruded FRP square or rectangular tube subframe is to be provided within the door.
 3. Core: For maximum rigidity and compressive strength a triangular shaped 3/8" cell phenolic resin impregnated kraft paper honeycomb core shall be used.
 4. Internal Reinforcement: High-modulus pultruded tubular FRP, high density polymer compression blocks, or plastic compression blocking at all hardware locations and corner locations.
 5. Faces: Door faces shall utilize a chemical resistant thermosetting polyester resin system with fiber reinforcing layers.
 6. Finish: The exposed FRP door faces shall have a 3-4 mils (wet) factory applied two-part aliphatic polyurethane full cured coating of industrial urethane.
 7. Astragals: All pairs of doors shall be furnished with an astragal from the door manufacturer made of the same pultruded FRP material as the door stile, rail and edges.
 8. Lites: Glass per job specification shall be factory furnished, glazed and installed.
 9. Louvers: Fiberglass inverted V blade privacy or flat blade louvers shall be factory furnished and installed.

2.4 ANCHORS

A. BOLT-IN:

1. Provide manufacturer's required number of 3/8" diameter x 4" long flat stainless steel sleeve anchors for masonry or concrete openings. Provide single bolt anchor at center of headers over four feet in nominal width. Stainless steel fasteners shall be furnished by the factory.

B. GROUT-IN:

1. Provide manufacturer's required number of wire or starp type masonry anchors for installation in block wall. Fill frame cavity with grout.

2.5 FASTENERS

- A. All fasteners for all hardware shall be type 316 stainless steel with no exception. No carbon steel or aluminum components shall be used.

2.6 HARDWARE

- A. Door shall be factory mortised and drilled for mortise template butt hinges, with #12x3" long stainless steel screw for hinge attachment. Provide 161 cylindrical lock bore, rim deadbolt, ANSI 86 mortise lock edge prep and pocked or flushbolt cutout as required.
- B. Frames shall be factory machined and drilled for all hardware requiring mortises.
- C. Hardware shall be furnished as listed in the drawings or specifications and shall be coordinated by the GC and installed by experienced mechanics.
- D. Supplier shall furnish manufacturer's standard templates, installation instructions, or full size approved door and frame preparation instructions approved by the architect and as required by the door and frame manufacturer prior to door and frame fabrication.

PART 3 - EXECUTION

3.1 IDENTIFICATION

- A. Factory mark all doors and frames using a chemical resistant plastic tag or indelible marker with identifying number, keyed to shop drawings, prior to shipment.

3.2 INSTALLATION

- A. Frames: Install in strict accordance with manufacturer's printed instructions. Set plumb and square, using shims for bolt-in of existing openings, or wood bracing prior to grouting of jambs. Use at least two 2x6 wood spreaders inside frame to maintain

critical opening dimension during grouting.

- B. Doors: Hang per manufacturer's printed instructions using special screws provided for hinge attachment. Install doors to swing freely and to stand open at any angle. All surface hardware shall be thru-bolted.

END OF SECTION 08 16 13

SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Access doors and frames.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Concealed Flanges:
1. Manufacturers: Subject to compliance with requirements, **[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ACUDOR Products, Inc]**
 - b. **[Babcock-Davis]**
 - c. **[J. L. Industries, Inc.; Activar Construction Products Group, Inc.]**
 - d. **[Larsen's Manufacturing Company]**
 - e. **[MIFAB, Inc]**
 - f. **[Milcor by Duravent; Duravent Group.]**
 - g. **[Nystrom, Inc.]**
 2. Description: Face of door flush with frame; with concealed flange for **[gypsum board]** installation and concealed hinge.
 3. Locations: **[Wall and ceiling]**.
 4. Door Size: <24" x 24" or **As required for equipment to be accessed**>.
 5. Uncoated Steel Sheet for Door: **[Nominal 0.060 inch, 16 gage]**, factory **[finished]**.
 6. Frame Material: **[Same material and thickness as door]**
 7. Latch and Lock: **[Cam latch, screwdriver operated]**

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
 - 2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.
 - 1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.
- E. Latch and Lock Hardware:
 - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
 - 2. Keys: Furnish two keys per lock and key all locks alike.

2.5 FINISHES

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

- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of **1 mil** for topcoat.
 - a. Color: **[As selected by Architect from full range of industry colors]**.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13

SECTION 08 33 13
COILING COUNTER DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Counter door assemblies.
2. Fire-rated counter door assemblies.

ACTION SUBMITTALS

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

1.2 CLOSEOUT SUBMITTALS

A. Maintenance Data: For coiling counter doors to include in maintenance manuals.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain coiling counter doors from single source from single manufacturer.

1. Obtain operators and controls from coiling counter door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Complying with NFPA 80; listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to **[NFPA 252]** **[or]** **[UL 10B]**.

2.3 COUNTER DOOR ASSEMBLY <Insert drawing designation>

- A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.
 - 1. Manufacturers: Subject to compliance with requirements, **[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Clopay Building Products]**
 - b. **[Cookson; a CornellCookson company]**
 - c. **[Cornell; a CornellCookson company]**
 - d. **[McKeon Door Company]**
 - e. **[Overhead Door Corporation]**
 - f. **[Wayne Dalton; a division of Overhead Door Corporation]**
- B. Operation Cycles: Door components and operators capable of operating for not less than **[100,000]**. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. STC Rating: **[26]**
- D. Curtain R-Value: For exterior doors provide as required by energy code prescriptive requirements.
- E. Door Curtain Material: **[Stainless steel]**.
- F. Door Curtain Slats: **[Flat]** profile slats of **[1-1/4-inch]** center-to-center height.
- G. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated **[stainless steel]** and finished **[to match door]**.
- H. Curtain Jamb Guides: **[Stainless steel]** with exposed finish matching curtain slats.**[Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.]**
- I. Hood: **[Match curtain material and finish]**.
 - 1. Shape: **[Square]**.
 - 2. Mounting: **[As indicated on Drawings]**.
- J. Integral Frame, Hood, and Fascia: **[Stainless]** steel.
 - 1. Mounting: **[As indicated on Drawings]**.
- K. Sill Configuration: **[Integral metal sill]**.
- L. Locking Devices: Equip door with **[locking device assembly]** **[and]** **[chain lock keeper]**.
 - 1. Locking Device Assembly: **[Single-jamb side]** locking bars, operable from **[inside with thumbturn]** .

- M. Manual Door Operator: [**Manufacturer's standard crank operator**].
1. Provide operator with through-wall shaft operation.
 2. Provide operator with manufacturer's standard removable operating arm.

- N. Door Finish:
1. Stainless Steel Finish: [**ASTM A480/A480M No. 2B (bright, cold rolled)**].
 2. Interior Curtain-Slat Facing: [**Match finish of exterior curtain-slat face**].

2.4 DOOR CURTAIN MATERIALS AND FABRICATION

- A. Door Curtains: Fabricate coiling counter door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Stainless Steel Door Curtain Slats: ASTM A240/A240M or ASTM A666, Type 304; sheet thickness of **0.025 inch**; and as required.

- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

1. Removable Posts and Jamb Guides: Manufacturer's standard.

2.5 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Stainless Steel: **0.025-inch**- thick, stainless steel sheet, Type 304, complying with ASTM A240/A240M or ASTM A666.

- B. Integral Frame, Hood, and Fascia: Welded sheet metal assembly of the following sheet metal(s):

1. Stainless Steel: Type 304, complying with ASTM A240/A240M or ASTM A666.

- C. Removable Metal Soffit: Formed or extruded from same metal and with same finish as curtain if hood is mounted above ceiling unless otherwise indicated.

2.6 COUNTERBALANCE MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-

sealed bearings or self-lubricating graphite bearings for rotating members.

- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, [**seamless**] [**or**] [**welded**] carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than **0.03 in./ft.** of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
 - 1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic closing device operates.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.7 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.

2.8 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: ASTM A480/A480M No. 4.
- C. Bright, Cold-Rolled, Unpolished Finish: ASTM A480/A480M No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 INSTALLATION, GENERAL

- A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install coiling counter doors, hoods, controls, and operators at the mounting locations indicated for each door.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain coiling counter doors.

END OF SECTION 08 33 13

SECTION 08 51 13 ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum windows.

1.2 DEFINITIONS

- A. Combination Assemblies: An assembly formed by a combination of two or more separate fenestration products whose frames are mulled together utilizing a combination mullion or reinforcing mullion.
- B. Combination Mullions: A horizontal or vertical member formed by joining two or more individual fenestration units together without a mullion stiffener.
- C. Reinforcing Mullions: A horizontal or vertical member with an added continuous mullion stiffener and joining two or more individual fenestration units along the sides of the mullion stiffener.

1.3 COORDINATION

- A. Finish Matching: Coordinate all exposed exterior aluminum components and trim to ensure uniform and consistent color and appearance. Use products specified in **[this Section]** as a benchmark. Architect's decision will be final as to whether a proposed product matches.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes.
- B. Shop Drawings:
1. Plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

E. Delegated Design Submittals: For reinforcing mullions, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Florida Product Approval: For each aluminum window, provide current approved Florida Product Approval or Miami Dade Notice of Acceptance (N.O.A.)

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

B. Installer Qualifications: Authorized representative who is trained and approved by aluminum window manufacturer.

C. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in [**state**] where Project is located and who is experienced in providing engineering services of the type indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver aluminum windows to Project site in original, unopened packages and store them in accordance with manufacturer's written instructions. Protect aluminum windows against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Handle aluminum windows in a manner that prevents damage before, during, and after installation.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install aluminum windows outside of limits recommended in writing by manufacturer.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.

b. Structural failures, including excessive deflection, water leakage,

- condensation, and air infiltration.
 - c. Faulty operation of movable sash and hardware.
 - d. Deterioration of materials and finishes beyond normal weathering.
 - e. Failure of insulating glass.
2. Warranty Period:
- a. Window:[**10**] years from date of Substantial Completion.
 - b. Glazing Units:[**10**] years from date of Substantial Completion.
 - c. Hardware:[**Three**] years from date of Substantial Completion.
 - d. Aluminum Finish:[**20**] years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain aluminum windows from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, to design reinforcing mullions.
- B. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Window Certification: FGIA certified with label attached to each window.
- C. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Minimum Performance Class [**AW**].
 - 2. Minimum Performance Grade: [**40**].
 - 3. Muller Window Systems: Evaluate and rate combination assemblies as single systems as determined by AAMA 450 in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 requirements.
- D. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
 - 1. Thermal Transmittance (U-factor): As determined in accordance with NFRC 100:
 - a. Fixed Windows: Not more than the prescriptive requirements of the most current edition of the applicable energy code.
 - b. Operable Windows: Not more than the prescriptive requirements of the most current edition of the applicable energy code.
 - 2. Solar Heat-Gain Coefficient (SHGC): As determined in accordance with NFRC

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- a. Fixed Windows: Not more than the prescriptive requirements of the most current edition of the applicable energy code.
 - b. Operable Windows: Not more than the prescriptive requirements of the most current edition of the applicable energy code.
3. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance in accordance with AAMA 1503, showing a CRF of **[45] [52] <Insert value>**.
- E. Thermal Movements: Provide aluminum windows, including anchorage, which allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change: **[120 deg F ambient; 180 deg F material surfaces]**.
- F. Outdoor-Indoor Transmission Class (OITC): Rated for not less than **[22]** OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.
- G. Windborne-Debris Impact Resistance: Passes TAS 201 missile-impact, TAS 202 Air, Water & Structural and TAS 203 cyclic-pressure tests in accordance with the Florida Building Code.

2.3 ALUMINUM WINDOWS

- A. Manufacturer: Basis of Design shall be Series PW7720A Aluminum Fixed Windows and Series CA-740 Outswing Aluminum Casement Windows by PGT Industries, Inc. Other manufacturers that may provide equivalent windows include but are not limited to the following:
1. **[EFCO Corporation]**
 2. **[Graham Architectural Products Corporation]**
 3. **[Kawneer Company, Inc.; Arconic Corporation]**
 4. **[OldCastle BuildingEnvelope (OBE)]**
 5. **[Wausau Window and Wall Systems; Apogee Wausau Group, Inc.]**
 6. **[Winco Window Company, Inc.]**
 7. **[YKK AP America Inc.]**
- B. Provide manufacturer's standard aluminum window assemblies consisting of frames, sashes, glass, hardware, fasteners, and all components and accessories as required for a complete installation.
- C. Operating Types: Provide the following operating types in locations indicated on Drawings:
1. Casement: **[Outswing]**.
 2. Fixed.

- D. Frames and Sashes: Aluminum extrusions of alloy, temper, and strength complying with AAMA/WDMA/CSA 101/I.S.2/A440.
1. Thermally Broken Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.
- E. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3.
1. Kind: Fully tempered [**where indicated on Drawings**].
- F. Windborne-Debris-Impact-Resistant Insulating-Glass Units: ASTM E2190, with two lites and complying with impact-resistance requirements in "Performance Requirements" Article.
1. Exterior Lite: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: [**Clear**].
 - b. Kind: [**Fully tempered**].
 2. Interior Lite: ASTM C1172, clear laminated glass with two plies of float glass.
 - a. Float Glass: [**As required by performance requirements indicated**].
 - b. Interlayer Thickness: [**As required by performance requirements indicated**].
 3. Filling: Fill space between glass lites with [**air**] or [**argon**].
 4. Low-E Coating: <**manufacturer's standard as required to meet energy code prescriptive requirements**>.
- G. Glazing System: [**Manufacturer's standard factory-glazing system that produces weathertight seal**].
- H. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
1. Exposed Hardware Color and Finish: [**As selected by Architect from manufacturer's full range**]
- I. Window Hardware: [**Casement**].
1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested in accordance with ASTM E405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets.
 - a. Type and Style: [**As selected by Architect from manufacturer's full range of types and styles**]

2. Hinges: [**Non-friction type, not less than two per sash**].
 3. Lock: [**Concealed multipoint lock operated by single lever handle or lift-type throw**].
 4. Limit Devices: [**Concealed support arms with adjustable, limited, hold-open**] limit devices designed to restrict sash opening.
 - a. Limit clear opening to [**4 inches**] for ventilation, with custodial key release.
- J. Weather Stripping: Provide manufacturer's standard full-perimeter weather stripping for each operable sash unless otherwise indicated.
- K. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
1. Exposed Fasteners: Avoid exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.
- L. Mullions: Provide manufacturer's standard combination and reinforcing mullions and cover plates matching window units, complete with anchors for support to structure. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide reinforcing mullions and cover plates capable of withstanding design wind loads of window units.

2.4 ACCESSORIES

- A. Dividers (False Muntins): Provide manufacturer's standard extruded-aluminum divider grilles in designs indicated for each sash lite.
1. Type: [**Permanently located at exterior lite**].
 2. Pattern: [**As indicated on Drawings**].
 3. Profile: [**As selected by Architect from manufacturer's full range**].
- B. Subsills: [**Nonthermal**], extruded aluminum subsills in configurations indicated on Drawings.
- C. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- D. Panning Trim: Profiles in sizes and configurations indicated on Drawings.

2.5 INSECT SCREENS

- A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.
1. Type and Location: [**Full, inside for outswing**] sashes.
- B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed

fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.

C. Glass-Fiber Mesh Fabric: [**18-by-14 or 18-by-16**] mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M.

1. Mesh Color: [**Manufacturer's standard**].

2.6 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA AMP 500 "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

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

C. Appearance of Finished Work: Noticeable variations in same piece are 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.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, [**vapor retarders,**] air and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Mullions: Install combination and reinforcing mullions for combination assemblies in accordance with manufacturer's written instructions.
- D. Install windows and components to drain water passing joints and condensation to the exterior.
- E. Separate aluminum from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

3.4 CLEANING AND PROTECTION

- A. Clean exposed surfaces immediately after installing windows using manufacturer's written instructions. Avoid damaging finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

- C. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 08 51 13

SECTION 08 80 00 GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Laminated glass.
3. Insulating glass.
4. Glazing tapes.
5. Miscellaneous glazing materials.

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.
- C. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of [the following products]; 12 inches square.
 1. Tinted glass.
 2. Laminated glass.
 3. Insulating glass.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- D. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.7 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: [10] years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: [10] years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: [10] years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations for Glass: Obtain glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the FBC and ASTM E1300:
 - 1. Design Wind Pressures: [As indicated on Drawings]
 - a. Wind Design Data: As indicated on Drawings.
 - b. Basic Wind Speed: <As indicated on Drawings>.
 - c. Importance Factor: <As indicated on Drawings>.
 - d. Exposure Category: As indicated on Drawings.
 - 2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 - 3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- D. Windborne-Debris Impact Resistance: Passes TAS 201 missile-impact, TAS 202 Air, Water & Structural and TAS 203 cyclic-pressure tests in accordance with the Florida Building Code.
- E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- F. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic glass lites, properties are based on units with lites [6 mm thick] [or thickness indicated].
2. For laminated glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

G. Acoustic Performance:

1. Exterior Glazing: [28] OITC.
2. Interior Glazing: [35] STC.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. NGA Publications: ["Laminated Glazing Reference Manual" and "Glazing Manual."]
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of [the SGCC] [the SGCC or another certification agency acceptable to authorities having jurisdiction] [or] [manufacturer]. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Thickness: Where glass thickness is indicated, it is a minimum. [Provide glass that complies with performance requirements and is not less than thickness indicated.]
1. Minimum Glass Thickness for Exterior Lites: [6 mm].
 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass [as needed to comply with "Performance Requirements" Article]. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass [as needed to

comply with "Performance Requirements" Article]. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

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

- a. [AGC Glass Company North America, Inc.]
- b. [Cardinal Glass Industries, Inc.]
- c. [Guardian Glass LLC]
- d. [Pilkington North America; NSG Group]
- e. [Saint-Gobain Glass Corp]

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

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

- a. [Dreamwalls by Gardner Glass Products]
- b. [Kuraray America, Inc.]
- c. [Pilkington North America; NSG Group]
- d. [Saflex; Eastman]

2. Construction: Laminate glass with [polyvinyl butyral interlayer] [ionoplast interlayer] [or] [cast-in-place and cured-transparent-resin interlayer] to comply with interlayer manufacturer's written instructions.

3. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.

4. Interlayer Color: Clear unless otherwise indicated.

B.

C. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with [one of] the following to comply with interlayer manufacturer's written instructions:

1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Kuraray America, Inc.]
 - b. [Saflex; Eastman]
2. Construction: Laminate glass with [polyvinyl butyral interlayer reinforced with polyethylene terephthalate film] [ionoplast interlayer] [or] [cast-in-place and cured-transparent-resin interlayer reinforced with polyethylene terephthalate film] to comply with interlayer manufacturer's written instructions.
3. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
4. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with [manufacturer's standard] primary and secondary sealants.
2. Perimeter Spacer: [Manufacturer's standard spacer material and construction]
 - 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) [Saint-Gobain Glass Corp]
 - 2) [Technoform Glass Insulation North America]
 - 3) [Thermix; a brand of Ensinger USA]
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
 1. Type recommended in writing by sealant or glass manufacturer.
- D. Spacers:
 1. Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks:
 1. Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: [120 deg F, ambient; 180 deg F, material surfaces].
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against

faces of removable stops. Start gasket applications at corners and work toward centers of openings.

- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

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

3.6 SEALANT GLAZING (WET)

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

3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction

operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

- A. Clear Glass Type <G1>: [Fully tempered] float glass.

1. Minimum Thickness: [6 mm].
2. Safety glazing required.

3.9 INSULATING-LAMINATED-GLASS SCHEDULE

- A. Clear Insulating, Laminated Glass Type <GL1>:

1. Basis-of-Design Product: <Kuraray America, Inc. SentryGlas>.
2. Overall Unit Thickness: [1-1/16 inch].
3. Minimum Thickness of Outdoor Lite: [5 mm].
4. Outdoor Lite: Clear [fully tempered] float glass.
5. Interspace Content: [Air].
6. Indoor Lite: Clear laminated glass with two plies of [annealed] (interior) and [heat-strengthened] (exterior) float glass.
 - a. Minimum Thickness of Each Glass Ply: [5 mm].
 - b. Interlayer Thickness: [0.090 inch].
7. Winter Nighttime U-Factor: as required by prescriptive energy code.
8. Summer Daytime U-Factor: as required by prescriptive energy code.
9. SGHC: as required by prescriptive energy code.
10. Safety glazing required.

END OF SECTION 08 80 00

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Framing systems.
 2. Suspension systems.
 3. Grid suspension systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Horizontal Deflection: For [composite] wall assemblies, limited to [1/240] of the wall height based on horizontal loading of [5 lbf/sq. ft.]
- B. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.
- C. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. minimum as required by the IBC/FBC.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with [AISI S220] for conditions indicated.
1. Steel Sheet Components: Comply with [AISI S220] requirements for metal unless otherwise indicated.
 2. Protective Coating: Comply with [AISI S220]; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.
 - a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
- B. Studs and Track: [AISI S220].
1. Minimum Base-Steel Thickness: [As required by performance requirements for horizontal deflection]
 2. Depth: [As indicated on Drawings]
- C. Slip-Type Head Joints: Where indicated, provide [one of] the following:
1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing [2-inch] minimum vertical movement.

2. Double-Track System: Top outer tracks, inside track with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
 3. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Steel Thickness: [0.0296 inch]
- E. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.
1. Depth: [3/4 inch]
 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
 3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Hanger Attachments to Concrete:
1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES [AC01] [AC193] [AC58] [or] [AC308] as appropriate for the substrate.
 - a. Uses: Securing hangers to structure.
 - b. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
 - c. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy [Group 1] stainless steel bolts, ASTM F593, and nuts, ASTM F594.
 2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Furring Channels (Furring Members):
1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 2. Steel Studs and Tracks:
 - a. Minimum Base-Steel Thickness: [0.0269 inch].

b. Depth: [As indicated on Drawings].

2.4 GRID SUSPENSION SYSTEMS

A. Grid Suspension Systems for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide [one of] the following:

1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.

2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM

2. C841 that apply to framing installation.
 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C844 that apply to framing installation.
 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
 - C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
 - D. Install bracing at terminations in assemblies.
 - E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLATION OF FRAMING SYSTEMS

- 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: [As required by horizontal deflection performance requirements] unless otherwise indicated.
 2. Multilayer Application: [As required by horizontal deflection performance requirements] unless otherwise indicated.
 3. Tile Backing Panels: [As required by horizontal deflection performance requirements] unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.

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

3.5 INSTALLATION OF GRID SUSPENSION SYSTEMS

- A. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

END OF SECTION 09 22 16

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.

1.2 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.3 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in

accordance with ASTM E119 by an independent testing agency.

2.3 GYPSUM BOARD, GENERAL

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

2.4 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, **[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[Armstrong Ceiling & Wall Solutions]**
- b. **[CertainTeed; SAINT-GOBAIN]**
- c. **[Georgia-Pacific Gypsum LLC]**
- d. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
- e. **[USG Corporation]**

2. Thickness: **5/8 inch.**
3. Long Edges: **[Tapered].**

- B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, **[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[American Gypsum]**
- b. **[CertainTeed; SAINT-GOBAIN]**
- c. **[Georgia-Pacific Gypsum LLC]**
- d. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
- e. **[USG Corporation]**

2. Thickness: **5/8 inch.**
3. Long Edges: **[Tapered].**

2.5 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
 - 1. Manufacturers: Subject to compliance with requirements, **[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**[Custom Building Products]
 - a. **[PermaBASE Building Products, LLC provided by National Gypsum Company]**
 - b. **[USG Corporation]**
 - 2. Thickness: **[5/8 inch]**
 - 3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: 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 Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use **[setting-type taping] [drying-type, all-purpose]** compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use **[setting-type, sandable topping]** compound.
 - 4. Finish Coat: For third coat, use **[setting-type, sandable topping]** compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use **[setting-type, sandable topping 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. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.
3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.7 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
 1. Use screws complying with ASTM C954 for fastening panels to steel members from **0.033 to 0.112 inch** thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
- E. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."
- F. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints

of adjacent panels not less than one framing member.

- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than **1/16 inch** of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than **8 sq. ft.** in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow **1/4- to 3/8-inch-** wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide **1/4- to 1/2-inch-** wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: [**Vertical surfaces unless otherwise indicated**].
 - 2. Ceiling Type: [**Ceiling surfaces**].
 - 3. Abuse-Resistant Type: [**As indicated on Drawings**].
 - 4. Impact-Resistant Type: [**As indicated on Drawings**].

5. 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-shaped 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 one framing member, **16 inches** minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers **[with screws; fasten face layers with adhesive and supplementary fasteners]**.

- 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 instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 INSTALLATION OF EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.

1. Install with **1/4-inch** open space where panels abut other construction or structural penetrations.

2. Fasten with corrosion-resistant screws.

3.5 INSTALLATION OF TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at **[locations indicated to receive tile]**.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 FINISHING OF GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: **[Where indicated on Drawings]**
 3. Level 3: **[Where indicated on Drawings]**.
 4. Level 4: **[At panel surfaces that will be exposed to view unless otherwise indicated]**.
 5. Level 5: **[Where indicated on Drawings]**.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.
- G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight,

construction, and other causes during remainder of the construction period.

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

END OF SECTION 09 29 00

SECTION 09 30 13 CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Ceramic mosaic tile.
 2. Thresholds.
 3. Crack isolation membranes.
 4. Setting material.
 5. Grout materials.

1.2 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.

1.3 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.4 WARRANTY

- A. System Warranty: Manufacturer's non-prorated comprehensive warranty that agrees to repair and replace defective installation areas, material, and labor that fail under normal usage within specified warranty period.
1. Warranty Period: **[25 years]** from date of Product Purchase.

PART 2 - 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 TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.2 CERAMIC MOSAIC TILE

- A. Ceramic Mosaic Tile Type.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
 - a. American Olean; a brand of Dal-Tile Corporation
 - 2. Certification: Porcelain tile certified by the Porcelain Tile Certification Agency.
 - 3. Module Size: **2 by 2 inches**.
 - 4. Thickness: **1/4 inch**.
 - 5. Face: Plain, with cushion edges.
 - 6. Surface: Smooth, without Slip resistant, with abrasive admixture.
 - 7. Product Use Classification: Interior, Wet (IW)Interior, Wet Plus.
 - 8. Tile Color and Pattern: Willow Speckle.
 - 9. Grout Color: As selected by Architect from manufacturer's full range.
 - 10. 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 Cove: Cove, module size 2 by 2 inch.
 - b. Base Cap for Thinset Mortar Installations: Surface bullnose, module size **[2 by 2 inches]**.
 - c. Wainscot Cap for Thinset Mortar Installations: Surface bullnose, module size **[2 by 2 inches]**.
 - d. 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.

- e. External Corners for Thinset Mortar Installations: Surface bullnose, module size **[2 by 2 inches]**.
- f. Internal Corners:
 - 1) Cove, module size **[2 by 2 inches]**.
 - 2) 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** above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to **1/2 inch** or less above adjacent floor surface.

2.4 CRACK ISOLATION MEMBRANES

- A. General: Manufacturer's standard product [, **selected from the following,**] that complies with ANSI A118.12 for [**high performance**] and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Crack Isolation Membrane, Polyethylene Sheet: Polyethylene faced on both sides with polyester fabric.
 - 1. Manufacturers: Subject to compliance with requirements, [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
 - a. **[Custom Building Products]**
 - b. **[Laticrete International, Inc.]**
 - c. **[MAPEI Corporation]**
 - d. **[Noble Company (The)]**
 - e. **[Schluter Systems L.P.]**

2.5 SETTING MATERIALS

- A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
 - 1. Manufacturers: Subject to compliance with requirements, [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

- a. [ARDEX Americas]
 - b. [Custom Building Products]
 - c. [Laticrete International, Inc.]
 - d. [MAPEI Corporation]
 - e. [Schluter Systems L.P.]
 - f. [Summitville Tiles, Inc.]
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.

2.6 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Water-Cleanable Epoxy Grout: ANSI A118.3.
 1. Manufacturers: Subject to compliance with requirements, **[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. [ARDEX Americas]
 - b. [Bostik; Arkema]
 - c. [Custom Building Products]
 - d. [Laticrete International, Inc.]
 - e. [MAPEI Corporation]
 - f. [Southern Grouts & Mortars, Inc]
 - g. [Summitville Tiles, Inc.]
 2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to **140 and 212 deg F**, respectively, and certified by manufacturer for intended use.
- C. Grout for PregROUTed Tile Sheets: Same product used in factory to pregROUT tile sheets.

2.7 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting and adhesive materials for installations indicated.
- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D4397, **4.0 mils** thick.
- C. Temporary Protective Coating: 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.

- 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: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with **[thinset mortar]** comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.
- B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with **[thinset mortar]** with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped **1/4 inch per foot** toward drains.

- D. 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.
- E. Substrate Flatness:
 - 1. For tile shorter than **15 inches**, confirm that structure or substrate is limited to variation of **1/4 inch in 10 ft.** from the required plane, and no more than **1/16 inch in 12 inches** when measured from tile surface high points.
- F. 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 INSTALLATION OF CERAMIC TILE SYSTEM

- A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
 - 1. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.
- B. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
 - 1. Allow crack isolation membrane to cure before installing tile or setting materials over it.
- C. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
 - 1. Add materials, water, and additives in accurate proportions.
 - 2. 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.
- D. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.

2. 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.
3. 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.
4. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
5. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
6. 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 use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - a. 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.
 - b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.

3.4 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 1. Remove grout residue from tile as soon as possible.
 2. Clean grout smears and haze from tile in accordance with tile and grout manufacturer's written instructions. 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.

3.5 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is

completed.

- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09 30 13

SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Vinyl base.
 2. Rubber molding accessories.
 3. Vinyl molding accessories.

1.2 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** long.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Product Schedule: For resilient base and accessory products. **[Use same designations indicated on Drawings.]**

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than **50 deg F** or more than **90 deg F**.

1.4 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than **[70 deg F]** or more than **[95 deg F]**, in spaces to receive 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]** or more than **[95 deg F]**.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL BASE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Mercer Vinyl Wall Base by Burke Flooring or comparable product by one of the following:
 - 1. Armstrong World Industries, Inc
 - 2. Flexco Corporation
 - 3. Johnsonite; a Tarkett company
 - 4. Roppe Corporation; Roppe Holding Company
- B. Product Standard: ASTM F1861, Type TV (vinyl, thermoplastic).
 - 1. Group: I (solid, homogeneous).
 - 2. Style and Location:
 - a. Style B, Cove: Provide in areas with resilient floor coverings.
- C. Minimum Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- F. Outside Corners: Job formed or preformed.
- G. Inside Corners: Job formed or preformed.
- H. Colors and Patterns: 317 GREIGE.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by 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. 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.
- C. 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. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than **[3 inches]** in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than **[3 inches]** in length.
 - a. **[Miter or cope]** corners to minimize open joints.

3.4 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.
- 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.

END OF SECTION 09 65 13

SECTION 09 65 19
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid vinyl floor tile.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: Full-size units of each color, texture, and pattern of floor tile required.
- C. Samples for Initial Selection: For each type of floor tile indicated.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

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. Floor Tile: Furnish one box for every **[50]** boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.5 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. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than **50 deg F** or more than **90 deg F**. Store floor tiles on flat surfaces.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than **[70 deg F]** or more than **[95 deg F]**, in spaces to receive floor tile during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than **[55 deg F]** or more than **[95 deg F]**.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 SOLID VINYL FLOOR TILE

- 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. **[Armstrong Flooring, Inc.]**
 - 2. **[Mannington Mills, Inc]**
 - 3. **[Patcraft; a division of Shaw Industries, Inc]**
 - 4. **[Roppe Corporation; Roppe Holding Company]**
 - 5. **[Shaw Industries Group, Inc.; Berkshire Hathaway Company]**
- B. Tile Standard: ASTM F1700.
 - 1. Class: **[As indicated by product designations]**.
 - 2. Type: **[A, Smooth Surface]** or **[B, Embossed Surface]** As indicated by product designations.
- C. Minimum Thickness: **[0.120 inch]** .
- D. Size: **[As indicated in Drawings]**

- E. Colors and Patterns: **[As indicated by manufacturer's designations]**.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Seamless-Installation Accessories:
 - 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - a. Colors: **[As selected by Architect from manufacturer's full range to contrast with floor tile] [Match floor tile] <Insert colors>**.
 - 2. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
- D. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.
- E. Joint Sealant for Resilient Terrazzo Floor Tile: Silicone sealant of type and grade recommended in writing by floor tile manufacturer to suit resilient terrazzo floor tile.
 - 1. Joint-Sealant Color: **[White] [As selected by Architect from manufacturer's full range to match floor tile] [Match floor tile] <Insert color>**.
- F. Sealers and Finish Coats for Resilient Terrazzo Floor Tile: Products recommended by floor tile manufacturer for resilient terrazzo floor tile.

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. Concrete Substrates: Prepare according to ASTM F710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than **[9]** pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed **[200 sq. ft.]**, and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum **[75]** percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. 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.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles **[square with room axis]**.
- 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.
- I. Seamless Installation:
 1. Heat-Welded Seams: Comply with ASTM F1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

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 09 65 19

SECTION 09 67 23
RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resinous flooring.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.

B. Samples: For each resinous floor system required and for each color and texture specified, **6 inches** square in size, applied to a rigid backing by Installer for this Project.

C. Samples for Initial Selection: For each type of exposed finish required.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.4 QUALITY ASSURANCE

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

1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

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

1. Apply full-thickness mockups on **96-inch-** square floor area [**selected by Architect**].
 - a. Include **96-inch** length of integral cove base with inside corner.
2. Simulate finished lighting conditions for Architect's review of mockups.
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.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.
- C. Close spaces to traffic during resinous flooring installation and for 24 hours after installation unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Flammability: Self-extinguishing in accordance with ASTM D635.

2.2 RESINOUS FLOORING <EPX-1>

- A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, resin-based monolithic floor surfacing designed to produce a seamless floor [**and integral cove base**].
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Everlast Epoxy Systems, Inc.: Everlast® Floor or comparable product by one of the following:
 - a. Everlast Epoxy Systems, Inc.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.
- C. System Characteristics:

1. Color and Pattern: **[As selected by Architect from manufacturer's full range]**
2. Wearing Surface: **[Textured for slip resistance] [Manufacturer's standard wearing surface]**
3. Overall System Thickness: **[Manufacturer's standard]**

2.3 INTEGRAL COVE BASE ACCESSORIES

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

3.2 PREPARATION

- A. Prepare and clean substrates in accordance with resinous flooring manufacturer's written instructions for substrate indicated to ensure adhesion.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 1. Roughen concrete substrates as follows:
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Comply with requirements in SSPC-SP 13/NACE No. 6, with a Concrete Surface Profile of 3 or greater in accordance with ICRI Technical Guideline No. 310.2R, unless manufacturer's written instructions are more stringent.
 2. Repair damaged and deteriorated concrete in accordance with resinous flooring manufacturer's written instructions.
 3. Moisture Testing: Perform tests so that each test area does not exceed **[200 sq. ft.]**, and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum **[75]** percent relative humidity level measurement.
 4. Alkalinity and Adhesion Testing: Perform tests recommended in writing by

resinous flooring manufacturer. Proceed with installation only after substrate alkalinity is not less than [6] or more than [8] pH unless otherwise recommended in writing by flooring manufacturer,

- C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates in accordance with manufacturer's written instructions.
 - 1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring in accordance with manufacturer's written instructions.
- D. Resinous Materials: Mix components and prepare materials in accordance with resinous flooring manufacturer's written instructions.

3.3 INSTALLATION

- A. Apply components of resinous flooring system in accordance with manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness specified.
 - 1. Coordinate installation of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 - 2. Cure resinous flooring components in accordance with manufacturer's written instructions. Prevent contamination during installation and curing processes.
 - 3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- B. Primer: Apply primer over prepared substrate at spreading rate recommended in writing by manufacturer.
- C. Waterproofing Membrane: Apply waterproofing membrane [**over entire substrate surface**], in thickness recommended in writing by manufacturer.
 - 1. Apply waterproofing membrane to integral cove base substrates.
- D. Reinforcing Membrane: Apply reinforcing membrane to [**substrate cracks**].
- E. Integral Cove Base Accessories: Adhesively install precast accessories before applying flooring coats and in accordance with manufacturer's written instructions.
- F. Field-Formed Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring coats. Apply in accordance with manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
 - 1. Integral Cove Base: [**4 inches**] high.
- G. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness specified for flooring system.

1. Aggregates: Broadcast aggregates at rate recommended in writing by manufacturer. After resin is cured, remove excess aggregates to provide surface texture indicated.

H. Grout Coat: Apply grout coat to fill voids in surface of final body coat.

I. Topcoats: Apply topcoats in number indicated for flooring system specified, at spreading rates recommended in writing by manufacturer, and to produce wearing surface specified.

3.4 FIELD QUALITY CONTROL

A. Material Sampling: Owner may, at any time and any number of times during resinous flooring installation, require material samples for testing for compliance with requirements.

1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reinstall flooring materials to comply with requirements.

B. Core Sampling: At Owner's direction and at locations designated by Owner, take one core sample per **1000 sq. ft.** of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.

3.5 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 67 23

SECTION 09 91 13 EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers.
2. Finish coatings.
3. Floor sealers and paints.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.

B. Samples: For each type of topcoat product.

C. Samples for Initial Selection: For each type of topcoat product.

D. Product Schedule: Use same designations indicated on Drawings and in the exterior painting schedules to cross-reference paint systems specified in this Section. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: [5] percent, but not less than [1 gal.] of each material and color applied.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

A. EXTERIOR CONCRETE BLOCK - OPAQUE

- 1. 1st Coat: Benjamin Moore Interior/Exterior Ultra Spec® Masonry Int/Ext Hi-Build Block Filler 571, NO COLOR SELECTED
- 2. 2nd Coat: Benjamin Moore Exterior Ultra Spec® EXT Satin N448, Color: White Dove OC-17 or as selected by architect & park manager.
- 3. 3rd Coat: Benjamin Moore Exterior Ultra Spec® EXT Satin N448, Color: White Dove OC-17 or as selected by architect & park manager.

B. EXTERIOR CONCRETE BLOCK - CLEAR

- 1. SUPER SPEC® Masonry Interior/Exterior 100% Acrylic Masonry Sealer N066, (0.95 mils thickness dry)

C. EXTERIOR CONCRETE - OPAQUE

- 1. 1st Coat: Benjamin Moore Interior/Exterior Ultra Spec® Masonry Int/Ext Hi-Build Block Filler 571, NO COLOR SELECTED
- 2. 2nd Coat: Benjamin Moore Exterior Ultra Spec® EXT Satin N448, Color: White Dove OC-17 or as selected by architect & park manager.
- 3. 3rd Coat: Benjamin Moore Exterior Ultra Spec® EXT Satin N448, Color: White Dove OC-17 or as selected by architect & park manager.

D. EXTERIOR FIBER CEMENT SIDING

- 1. 1st Coat: Benjamin Moore Interior/Exterior Ultra Spec® Masonry Int/Ext 100% Acrylic Sealer 608, NO COLOR SELECTED
- 2. 2nd Coat: Benjamin Moore Exterior Ultra Spec® EXT Satin N448, Color: White Dove OC-17 or as selected by architect & park manager.
- 3. 3rd Coat: Benjamin Moore Exterior Ultra Spec® EXT Satin N448, Color: White Dove OC-17 or as selected by architect & park manager.

E. EXTERIOR FIBER CEMENT TRIM

- 1. 1st Coat: Benjamin Moore Interior/Exterior Ultra Spec® Masonry Int/Ext 100% Acrylic Sealer 608, NO COLOR SELECTED
- 2. 2nd Coat: Benjamin Moore Exterior Ultra Spec® EXT Satin N448, Color: White Dove OC-17 or as selected by architect & park manager.
- 3. 3rd Coat: Benjamin Moore Exterior Ultra Spec® EXT Satin N448, Color:

White Dove OC-17 or as selected by architect & park manager.

F. CONCRETE FLOOR SEALER

1. 1st Coat: For First Coat Refer to Technical Data Sheet
2. 2nd Coat: Benjamin Moore Interior/Exterior TuffCrete® Solvent Acrylic Concrete Stain & Waterproofing Sealer CST-5XXX, Color: Gray Pearl CST-5308
3. 3rd Coat: Benjamin Moore Interior/Exterior TuffCrete® Solvent Acrylic Concrete Stain & Waterproofing Sealer CST-5XXX, Color: Gray Pearl CST-5308

G. HOLLOW METAL DOORS AND FRAMES

1. 1st Coat: Benjamin Moore Ultra Spec® HP Acrylic Enamel Primer HP04, NO COLOR SELECTED
2. 2nd Coat: Benjamin Moore Ultra Spec® DTM Acrylic Semi-Gloss Enamel HP29, Color: Indian River 985 or as selected by architect and park manager.
3. 3rd Coat: Benjamin Moore Ultra Spec® DTM Acrylic Semi-Gloss Enamel HP29, Color: Indian River 985 or as selected by architect and park manager.

H. FRP / FIBERGLASS DOORS AND FRAMES

1. Gel-Coat by manufacturer, Color: white or as selected by architect and park manager

PART 2 - MANUFACTURERS

- A. Acceptable Manufacturer: Benjamin Moore and Co., which is located at: 101 Paragon Dr Montvale, NJ 07645; Toll Free Tel: 866-708-9181; Email: info@benjaminmoore.com; Web: www.benjaminmoore.com

2.2 MATERIALS - GENERAL

- A. Compatibility: Provide materials that are compatible with one another, and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.3 MIXING AND TINTING

- A. Except where specifically noted in this section, all paint shall be ready-mixed and pre-tinted. Agitate all paint prior to and during application to ensure uniform color, gloss, and consistency.
- B. Thinner addition shall not exceed manufacturer's printed recommendations. Do not use kerosene or other organic solvents to thin water-based paints.

- C. Where paint is to be sprayed, thin according to manufacturer's current guidelines.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
 2. Fiber-Cement Board: 12 percent.
 3. Masonry (Clay and Concrete Masonry Units): 12 percent.
 4. Wood: 15 percent.
 5. Portland Cement Plaster: 12 percent.
 6. 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 dry and sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions 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 specified in this Section.

- 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 11.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- 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. 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 remove sanding dust.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 INSTALLATION

- A. Apply paints in accordance with manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint [both sides] [exterior side] and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in the exterior painting schedules may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and

topcoat paint manufacturers.

- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

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 instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 - 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 - 3. Allow empty paint cans to dry before disposal.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore

damaged or defaced painted surfaces.

END OF SECTION 09 91 13

SECTION 09 91 16 INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers.
2. Finish coatings.
3. Floor sealers and paints.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.

B. Samples: For each type of topcoat product.

C. Samples for Initial Selection: For each type of topcoat product.

D. Product Schedule: Use same designations indicated on Drawings and in the exterior painting schedules to cross-reference paint systems specified in this Section. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: [5] percent, but not less than [1 gal.] of each material and color applied.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

A. INTERIOR CONCRETE BLOCK - OPAQUE

- 1. 1st Coat: Benjamin Moore Interior/Exterior Ultra Spec® Masonry Int/Ext Hi-Build Block Filler 571, NO COLOR SELECTED
- 2. 2nd Coat: Benjamin Moore Exterior Ultra Spec® EXT Satin N448, Color: White Dove OC-17 or as selected by architect & park manager.
- 3. 3rd Coat: Benjamin Moore Exterior Ultra Spec® EXT Satin N448, Color: White Dove OC-17 or as selected by architect & park manager.

B. INTERIOR GYPSUM BOARD CEILINGS

- 1. 1st Coat: Primer Optional
- 2. 2nd Coat: Benjamin Moore Interior Aura® Bath & Spa Matte 532, Color: White Dove OC-17 or as selected by architect & park manager.
- 3. 3rd Coat: Benjamin Moore Interior Aura® Bath & Spa Matte 532, Color: White Dove OC-17 or as selected by architect & park manager.

C. INTERIOR TRIM (WOOD)

- 1. 1st Coat: Benjamin Moore Fresh Start Multi-Purpose Oil Based Primer 024, Color: White Dove OC-17 or as selected by architect & park manager.
- 2. 2nd Coat: Benjamin Moore Super Hide Latex Semi-Gloss Enamel 283, Color: White Dove OC-17 or as selected by architect & park manager.
- 3. 3rd Coat: Benjamin Moore Super Hide Latex Semi-Gloss Enamel 283, Color: White Dove OC-17 or as selected by architect & park manager.

D. CONCRETE FLOOR SEALER

- 1. 1st Coat: For First Coat Refer to Technical Data Sheet
- 2. 2nd Coat: Benjamin Moore Interior/Exterior TuffCrete® Solvent Acrylic Concrete Stain & Waterproofing Sealer CST-5XXX, Color: Gray Pearl CST-5308
- 3. 3rd Coat: Benjamin Moore Interior/Exterior TuffCrete® Solvent Acrylic Concrete Stain & Waterproofing Sealer CST-5XXX, Color: Gray Pearl CST-5308

E. HOLLOW METAL DOORS AND FRAMES

- 1. 1st Coat: Benjamin Moore Ultra Spec® HP Acrylic Enamel Primer HP04,

NO COLOR SELECTED

2. 2nd Coat: Benjamin Moore Ultra Spec® DTM Acrylic Semi-Gloss Enamel HP29, Color: Indian River 985 or as selected by architect and park manager.
3. 3rd Coat: Benjamin Moore Ultra Spec® DTM Acrylic Semi-Gloss Enamel HP29, Color: Indian River 985 or as selected by architect and park manager.

F. FRP / FIBERGLASS DOORS AND FRAMES

1. Gel-Coat by manufacturer, Color: white or as selected by architect and park manager

PART 2 - MANUFACTURERS

- A. Acceptable Manufacturer: Benjamin Moore and Co., which is located at: 101 Paragon Dr., Montvale, NJ 07645; Toll Free Tel: 866-708-9181; Email: info@benjaminmoore.com; Web: www.benjaminmoore.com

2.2 MATERIALS - GENERAL

- A. Compatibility: Provide materials that are compatible with one another, and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.3 MIXING AND TINTING

- A. Except where specifically noted in this section, all paint shall be ready-mixed and pre-tinted. Agitate all paint prior to and during application to ensure uniform color, gloss, and consistency.
- B. Thinner addition shall not exceed manufacturer's printed recommendations. Do not use kerosene or other organic solvents to thin water-based paints.
- C. Where paint is to be sprayed, thin according to manufacturer's current guidelines.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Concrete: 12 percent.

2. Fiber-Cement Board: 12 percent.
 3. Masonry (Clay and Concrete Masonry Units): 12 percent.
 4. Wood: 15 percent.
 5. Portland Cement Plaster: 12 percent.
 6. 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 dry and sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions 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 specified in this Section.
- 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 11.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- 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 remove sanding dust.
 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.

3.3 INSTALLATION

- A. Apply paints in accordance with manufacturer's written instructions.
1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Paint [both sides] [exterior side] and edges of exterior doors and entire exposed surface of exterior door frames.
 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 5. Primers specified in the exterior painting schedules may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.
- B. Tint undercoats same color as topcoat but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats

until cured film has a uniform paint finish, color, and appearance.

- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

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 instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 - 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 - 3. Allow empty paint cans to dry before disposal.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 91 16

SECTION 10 21 13.19
PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-plastic toilet compartments.

1.2 COORDINATION

- A. Coordinate requirements for [**overhead supports**,]blocking, reinforcing, and other supports concealed within wall[**and ceiling**] to ensure that toilet compartments can be supported and installed as indicated.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Solid-plastic toilet compartments:
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.
5. Show[**ceiling grid, ceiling-mounted items, and**] overhead support or bracing locations.
6. **<Insert requirements>**.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment.

1. Include Samples of hardware and accessories involving material and color selection.

D. Samples for Verification: Actual sample of finished products for each type of toilet compartment, hardware, and accessory.

1. Size: [**Manufacturer's standard size**] **<Insert size>**.

E. Product Schedule: For toilet compartments, prepared by or under the supervision of

supplier, detailing location and selected colors for toilet compartment material.

- F. Delegated Design Submittals: For grab bars mounted on toilet compartment panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- 1. Include structural design calculations indicating compliance with specified structural-performance requirements.

- G. Sustainable Design Submittals:

- 1. Third-Party Certifications: For each product.
 - 2. Third-Party Certified Life Cycle Assessment: For each product.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For toilet compartments.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Materials: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Door Hinges: [**One**] <Insert number> hinge(s) with associated fasteners.
 - 2. Latch and Keeper: [**One**] <Insert number> latch(es) and keeper(s) with associated fasteners.
 - 3. Door Bumper: [**One**] <Insert number> bumper(s) with associated fasteners.
 - 4. Door Pull: [**One**] <Insert number> door pull(s) with associated fasteners.
 - 5. Fasteners: [**10**] <Insert number> fasteners of each size and type.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain plastic toilet compartments from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert value> percent.

- B. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.
- C. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:
 - 1. Panels are able to withstand a concentrated load on grab bar of at least **250 lbf** applied at any direction and at any point, without deformation of panel.
- D. Regulatory Requirements: Comply with applicable provisions in [the USDOJ's "2010 ADA Standards for Accessible Design"] [and] [ICC A117.1] <Insert accessibility regulation> for toilet compartments designated as accessible.

2.3 SOLID-PLASTIC TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1. [AJW Architectural Products]
 - 2. [All American Metal Corp]
 - 3. [American Sanitary Partition Corporation]
 - 4. [ASI Accurate Partitions]
 - 5. [ASI Global Partitions]
 - 6. [General Partitions Mfg. Corp]
 - 7. [Hadrian Inc.; Zurn Industries, LLC]
 - 8. [Knickerbocker Partition Corporation]
 - 9. [Metpar Corp]
 - 10. [Partition Systems International of South Carolina (PSISC); Columbia Systems International of South Carolina LLC]
 - 11. [Scranton Products]
 - 12. [Weis/Robart Partitions, Inc.]
 - 13. <Insert manufacturer's name>
- B. Toilet-Enclosure Style: [Overhead braced] [Floor anchored] [Ceiling hung] [Floor-and-ceiling anchored][, privacy type].
- C. Entrance-Screen Style: [Overhead braced] [Floor anchored] [Ceiling hung] [Floor-and-ceiling anchored].
- D. Urinal-Screen Style: [Wall hung] [Floor anchored] [Overhead braced] [Post to ceiling].
- E. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) material, not less than **1 inch** thick, seamless, with eased edges, and with homogenous color throughout thickness of material.[**Provide with no-sightline system consisting of door and pilaster lapped edges on strike side of door and door and pilaster lapped edges on hinge side of door (unless continuous hinge is used).**]

1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
 2. Heat-Sink Strip: Manufacturer's continuous, [**extruded-aluminum**] [**or**] [**stainless steel**] strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
 3. Color: [**One color**] [**Two colors**] in each room [**as indicated by manufacturer's designations**] [**as selected by Architect from manufacturer's full range**] <Insert color>.
- F. Entrance-Screen Construction: Matching panel construction.
- G. Urinal-Screen Construction: Matching panel construction.
- H. Pilaster Shoes: Manufacturer's standard design; [**solid plastic**] [**or**] [**stainless steel**].
1. Plastic Color: [**Matching pilaster**] [**Contrasting with pilaster, as indicated by manufacturer's designations**] [**Contrasting with pilaster, as selected by Architect from manufacturer's full range**] <Insert color>.
- I. Pilaster Sleeves (Caps): Manufacturer's standard design; [**solid plastic**] [**or**] [**stainless steel**].
1. Plastic Color: [**Matching pilaster**] [**Contrasting with pilaster, as indicated by manufacturer's designations**] [**Contrasting with pilaster, as selected by Architect from manufacturer's full range**] <Insert color>.
- J. Urinal-Screen Post: Manufacturer's standard post design of [**material matching the thickness and construction of pilasters**] [**or**] [**1-3/4-inch- square aluminum tube with satin finish**] <Insert requirement>; with shoe[**and sleeve (cap)**] matching that on the pilaster.
- K. Brackets (Fittings):
1. Stirrup Type: Ear or U-brackets, [**aluminum**] [**stainless steel**].
 2. Full-Height (Continuous) Type: Manufacturer's standard design; [**solid plastic or extruded aluminum**] [**solid plastic**] [**extruded aluminum**] [**stainless steel**].
 - a. Plastic Color: [**Matching panel**] [**Contrasting with panel, as indicated by manufacturer's designations**] [**Contrasting with panel, as selected by Architect from manufacturer's full range**] <Insert color>.
- L. Overhead Cross Bracing for Ceiling-Hung Units: As recommended by manufacturer and fabricated from solid plastic.
- 2.4 HARDWARE AND ACCESSORIES
- A. Door Hardware and Accessories: Manufacturer's operating hardware and accessories.[**Mount with through bolts.**]
1. Hinges:

- a. Manufacturer's paired, wraparound, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door.
 - 1) Material, Paired Hinge: Aluminum.
 - b. Manufacturer's **[continuous, cam type that swings to a closed or partially open position]** **[continuous, spring-loaded type]**, allowing emergency access by lifting door.
 - 1) Material, Continuous Hinge: **[Aluminum]** **[Stainless steel]** **[Manufacturer's standard]**.
 - c. Manufacturer's integral hinge for solid-plastic doors, allowing emergency access by lifting door.
 - 1) Material, Integral Hinge: Nylon gravity cam unit with stainless steel pins/screws.
 - d. Manufacturer's standard hinge.
 - e. **<Insert requirement>**.
2. Latch and Keeper: Manufacturer's surface-mounted latch unit, designed for emergency access, and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible.
 - a. Material: **[Aluminum]** **[Chrome-plated zamac]** **[Stainless steel]** **[Manufacturer's standard]**.
 3. Coat Hook: Manufacturer's combination hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories.
 - a. Material: **[Chrome-plated zamac]** **[Stainless steel]** **[Manufacturer's standard]**.
 4. Door Bumper: Manufacturer's rubber-tipped bumper at outswinging doors.
 - a. Material: **[Chrome-plated zamac]** **[Stainless steel]** **[Manufacturer's standard]**.
 5. Door Pull: Manufacturer's unit at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible.
 - a. Material: **[Chrome-plated zamac]** **[Stainless steel]** **[Manufacturer's standard]**.
- B. Door Hardware and Accessories, Heavy Duty: Manufacturer's heavy-duty institutional operating hardware and accessories.

1. Hinges: Manufacturer's minimum **0.062-inch**- thick, stainless steel [**paired, wraparound, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees**] [**continuous, cam type that swings to a closed or partially open position**] [**continuous, spring-loaded type**] <Insert requirement>, allowing emergency access by lifting door. Mount with through bolts.
 2. Latch and Keeper: Manufacturer's heavy-duty, surface-mounted, cast stainless steel latch unit, designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible. Mount with through bolts.
 3. Coat Hook: Manufacturer's heavy-duty, combination cast stainless steel hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories. Mount with through bolts.
 4. Door Bumper: Manufacturer's heavy-duty, rubber-tipped, cast stainless steel bumper at outswinging doors. Mount with through bolts.
 5. Door Pull: Manufacturer's heavy-duty, cast stainless steel pull at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible. Mount with through bolts.
- C. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- D. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.5 MATERIALS

- A. Aluminum Castings: ASTM B26/B26M.
- B. Aluminum Extrusions: **ASTM B221**.
- C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless Steel Castings: ASTM A743/A743M.
- E. Zamac: ASTM B86, commercial zinc-alloy die castings.

2.6 FABRICATION

- A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

- B. Overhead-Braced Units: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Ceiling-Hung Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.
- E. Floor-and-Ceiling-Anchored Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
- F. Urinal-Screen Posts: Manufacturer's standard corrosion-resistant anchoring assemblies at posts and walls, with leveling adjustment nuts at **tops and** bottoms of posts. Provide shoes **and sleeves (caps)** at posts to conceal anchorage.
- G. Door Size and Swings: Unless otherwise indicated, provide **24-inch-** wide, inswinging doors for standard toilet enclosures and **36-inch-** wide, outswinging doors with a minimum **32-inch-** wide, clear opening for toilet enclosures designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels or Screens: **1/2 inch.**

- b. Panels or Screens and Walls: **1 inch**.
 - 2. Stirrup Brackets: Secure panels or screens to walls and to pilasters with no fewer than **[two brackets attached] [three brackets attached at midpoint and]** near top and bottom of panel or screen.
 - a. Locate wall brackets, so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
 - 3. Full-Height (Continuous) Brackets: Secure panels or screens to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners, so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
 - B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than **1-3/4 inches** into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels and adjust, so tops of doors are parallel with overhead brace when doors are in closed position.
 - C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than **2 inches** into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust, so tops of doors are level with tops of pilasters when doors are in closed position.
 - D. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust, so bottoms of doors are level with bottoms of pilasters when doors are in closed position.
 - E. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust, so doors are level and aligned with panels, when doors are in closed position.
 - F. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.
- 3.3 ADJUSTING
- A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION 102113.19

SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Public-use washroom accessories.
 2. Public-use shower room accessories.
 3. Childcare accessories.
 4. Under lavatory guards.
 5. Custodial accessories.

1.2 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Structural Performance: Design accessories and fasteners to comply with the following requirements:
1. Grab Bars: Installed units are able to resist **250 lbf** concentrated load applied in any direction and at any point.
 2. Shower Seats: Installed units are able to resist [**360 lbf**] concentrated load applied in any direction and at any point.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain [**each type of public-use washroom accessory**] from single source from single manufacturer.
- B. Toilet Tissue (Double Surface Mount) Dispenser:
1. Basis-of-Design Product: Subject to compliance with requirements, provide A&J

U-804 or comparable product by one of the following:

- a. **[ASI-American Specialties, Inc.]**
- b. **[Bobrick Washroom Equipment, Inc]**
- c. **[Bradley Corporation]**
- d. **[Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.]**

2. Description: Dual Hooded Toilet Tissue Dispenser – non controlled.
3. Mounting: Surface mounted.
4. Capacity: two standard diameter rolls.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. High-Speed Air Hand Dryer:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Word Dryer Corporation Nova 1 #0830 or comparable product by one of the following:

- a. **[AJW Architectural Products]**
- b. **[American Dryer, Inc]**
- c. **[ASI-American Specialties, Inc.]**
- d. **[Bobrick Washroom Equipment, Inc]**
- e. **[Bradley Corporation]**
- f. **[Dyson Inc.]**
- g. **[Excel Dryer Inc.]**
- h. **[Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.]**

D. Soap Dispenser:

1. Basis-of-Design Product: Subject to compliance with requirements, provide A&J U-126 or comparable product by one of the following:

- a. **[ASI-American Specialties, Inc.]**
- b. **[Bobrick Washroom Equipment, Inc]**
- c. **[Bradley Corporation]**
- d. **[Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.]**

2. Description: Designed for manual operation and dispensing soap in **[liquid or lotion]** form.
3. Mounting: **[Vertically oriented, surface mounted]**.
4. Capacity: **<40 ounces>**.
5. Materials: **<stainless steel>**.

E. Grab Bar:

1. Basis-of-Design Product: Subject to compliance with requirements, provide A&J UG30-A or comparable product by one of the following:

- a. **[ASI-American Specialties, Inc.]**

- b. **[Bobrick Washroom Equipment, Inc]**
 - c. **[Bradley Corporation]**
 - d. **[Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.]**
 2. Mounting: Flanges with **[concealed]** fasteners.
 3. Material: Stainless steel, **#18 gauge**.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
 4. OD: **[1-1/2 inches]**.
 5. Configuration and Length: **[As indicated on Drawings]**.
- F. Sanitary-Napkin Disposal Unit:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide A&J U491 Surface Mounted Sanitary Napkin Disposal or comparable product by one of the following:
 - a. **[ASI-American Specialties, Inc.]**
 - b. **[Bobrick Washroom Equipment, Inc]**
 - c. **[Bradley Corporation]**
 - d. **[Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.]**
 2. Mounting: **[Surface mounted]**.
 3. Door or Cover: Self-closing, disposal-opening cover.
 4. Receptacle: Removable.
 5. Material and Finish: **[Stainless steel, ASTM A480/A480M No. 4 finish (satin)]**.
- G. Mirror Unit:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide A&J U700 Series Angle Frame Mirror or comparable product by one of the following:
 - a. **[ASI-American Specialties, Inc.]**
 - b. **[Bobrick Washroom Equipment, Inc]**
 - c. **[Bradley Corporation]**
 - d. **[Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.]**
 2. Frame: **[Stainless steel angle, 18 gauge]**.
 - a. Corners: **[Welded and ground smooth]**.
 3. Size: **<24 x 36 U.N.O on drawings>**.
 4. Hangers: **[Manufacturer's standard rigid, tamper and theft resistant]**.

H. Coat Hook:

1. Basis-of-Design Product: Subject to compliance with requirements, provide A&J US19 Security Hook / US40 Security Hook Strip Exposed Mount or comparable product by one of the following:
 - a. **[ASI-American Specialties, Inc.]**
 - b. **[Bobrick Washroom Equipment, Inc]**
 - c. **[Bradley Corporation]**
 - d. **[Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.]**
2. Description: [US19 **Single-prong unit**], US40 Multiple-prong unit
3. Mounting: [**Exposed**].
4. Material and Finish: [**Stainless steel, ASTM A480/A480M No. 4 finish (satin)**].

I. Fixed-Height Adult Changing Station:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Foundations Worldwide Model 100SSE-SM Special Needs Stainless Steel Diaper Changing Station or comparable product by one of the following:
 - a. **<Pressalit Inc.>**
 - b. **<Koala Kare Products, a division of Bobrick>**
2. Description: Horizontal unit that opens by folding down from stored position and with adjustable strap.
 - a. Engineered to support minimum of [**400 lb** static load when opened.
3. Mounting: [**Surface mounted, with unit projecting not more than 4 inches from wall when closed**].
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: [**Stainless steel, ASTM A480/A480M No. 4 finish (satin), with replaceable insulated polystyrene tray liner and rounded plastic corners**].
6. Liner Dispenser: Provide [**separate, locking**] dispenser for disposable sanitary liners.

J. Shower Curtain Rod:

1. Basis-of-Design Product: Subject to compliance with requirements, provide A&J UX2-B## 1 ¼" Diameter Shower Curtain Rod, B- type flange or comparable product by one of the following:
 - a. **[ASI-American Specialties, Inc.]**
 - b. **[Bobrick Washroom Equipment, Inc]**
 - c. **[Bradley Corporation]**
 - d. **[Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.]**

2. Description: [**1-1/4-inch-**] OD, straight rod.
3. Configuration: [**As indicated on Drawings**].
4. Mounting Flanges: [**Exposed**] fasteners; in [**material and finish matching rod**].
5. Rod Material and Finish: [**Stainless steel, ASTM A480/A480M No. 4 finish (satin)**].

K. Shower Curtain:

1. Basis-of-Design Product: Subject to compliance with requirements, provide A&J UX250A-3672 36"W x 72"H Shower Curtain - Anti-Bacterial Fabric or comparable product by one of the following:
 - a. [**ASI-American Specialties, Inc.**]
 - b. [**Bobrick Washroom Equipment, Inc**]
 - c. [**Bradley Corporation**]
 - d. [**Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.**]
2. Size: Minimum [**12 inches**] wider than opening by **72 inches** high.
3. Material: [**Nylon-reinforced vinyl, minimum 9 oz. or 0.008-inch- thick vinyl, with integral antibacterial and flame-retardant agents**].
4. Color: [**White**]
5. Grommets: Corrosion resistant at minimum **6 inches** o.c. through top hem.
6. Shower Curtain Hooks: UX169 or equivalent [**stainless steel, spring wire curtain hooks with snap fasteners**], sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

L. Folding Shower Seat:

1. Basis-of-Design Product: Subject to compliance with requirements, provide A&J U921 Handed Retractable Bariatric Shower Seat (ADA Compliant – Surface Mounted with legs) or comparable product by one of the following:
 - a. [**ASI-American Specialties, Inc.**]
 - b. [**Bobrick Washroom Equipment, Inc**]
 - c. [**Bradley Corporation**]
 - d. [**Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.**]
2. Configuration: [**L-shaped seat, designed for wheelchair access**].
3. Seat: [**Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect**]
4. Mounting Mechanism: [**Stainless steel, ASTM A480/A480M No. 4 finish (satin)**].
5. Dimensions: <**32" wide x 20 ¼ deep" (seating area)**>
6. Support Legs: Four (4) #18 Ga Stainless Steel tubing with anti-slip feet, adjustable

M. Diaper-Changing Station:

1. Basis-of-Design Product: Subject to compliance with requirements, provide A&J U944 Baby Changing Station or comparable product by one of the following:
 - a. **[ASI-American Specialties, Inc.]**
 - b. **[Bradley Corporation]**
 - c. **[Diaper Deck & Co.]**
 - d. **[Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.]**
 - e. **[Koala Kare Products; Bobrick Washroom Equipment, Inc.]**
2. Description: **[Horizontal]** unit that opens by folding down from stored position and with child-protection strap.
 - a. Engineered to support minimum of **[200 lb]** static load when opened.
3. Mounting: **[Surface mounted, with unit projecting not more than 4 inches from wall when closed].**
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: **[HDPE in manufacturer's standard color]**
6. Liner Dispenser: Provide **[built-in]** dispenser for disposable sanitary liners.

2.3 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

1. Manufacturers: Subject to compliance with requirements, **[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Buckaroos, Inc.]**
 - b. **[Plumberex Specialty Products, Inc.]**
 - c. **[Truebro; IPS Corporation]**
2. 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.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.4 CUSTODIAL ACCESSORIES

A. Source Limitations: Obtain **[each type of custodial accessory]** from single source from single manufacturer.

B. Custodial Utility Shelf:

1. Manufacturers: Subject to compliance with requirements, **[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. [AJW Architectural Products]
 - b. [ASI-American Specialties, Inc.]
 - c. [Bobrick Washroom Equipment, Inc]
 - d. [Bradley Corporation]
 - e. [Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.]
2. Description: With exposed edges turned down not less than **1/2 inch** and supported by two triangular brackets welded to shelf underside.
 3. Size: [**16 inches long by 6 inches deep**].
 4. Material and Finish: Not less than nominal **18# gauge** thick stainless steel, ASTM A480/A480M No. 4 finish (satin).
- C. Custodial Mop and Broom Holder:
1. Manufacturers: Subject to compliance with requirements, [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
 - a. [AJW Architectural Products]
 - b. [ASI-American Specialties, Inc.]
 - c. [Bobrick Washroom Equipment, Inc]
 - d. [Bradley Corporation]
 - e. [Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.]
 2. Description: [**Unit with shelf, hooks, holders, and rod suspended beneath shelf**].
 3. Length: [**36 inches**].
 4. Hooks: [**Four**].
 5. Mop/Broom Holders: [**Three**], spring-loaded, rubber hat, cam type.
 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - a. Shelf: Not less than nominal **0.05-inch-** thick stainless steel.
 - b. Rod: Approximately **1/4-inch-** diameter stainless steel.

2.5 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, **0.031-inch-** minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), **0.036-inch-** minimum nominal thickness.
- D. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

- E. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).
- F. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.6 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 in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units' level, plumb, and firmly anchored in locations and at heights indicated.
 - 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 10 28 00

SECTION 10 44 16
FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, [**hand-carried**] fire extinguishers [**and mounting brackets for fire extinguishers**].

1.2 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.3 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: [**Six**] years from date of Substantial Completion.

PART 2 - PRODUCTS

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

- a. **[Babcock-Davis]**
- b. **[Guardian Fire Equipment, Inc]**
- c. **[J. L. Industries, Inc.; Activar Construction Products Group, Inc.]**
- d. **[Kidde; Carrier Global Corporation]**
- e. **[Larsen's Manufacturing Company]**
- f. **[Nystrom, Inc.]**
- g. **[Potter Roemer LLC; a Division of Morris Group International]**

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: **[Stainless steel]**.
5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B[, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging].

- B. Multipurpose Dry-Chemical Type in Steel Container <FE>: UL-rated **[4-A:60-B:C, 10-Ib]** 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 or **[black]** baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, **[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[Babcock-Davis]**
- b. **[Guardian Fire Equipment, Inc]**
- c. **[J. L. Industries, Inc.; Activar Construction Products Group, Inc.]**
- d. **[Kidde; Carrier Global Corporation]**
- e. **[Larsen's Manufacturing Company]**
- f. **[Nystrom, Inc.]**
- g. **[Potter Roemer LLC; a Division of Morris Group International]**

2. 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.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
 1. Mounting Height: Top of fire extinguisher to be at [**42 inches**] above finished floor.

END OF SECTION 10 44 16

SECTION 11 00 00

HEAVY DUTY TWO POST VEHICLE LIFT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Heavy Duty Two-post Vehicle Lift

ACTION SUBMITTALS

B. Product Data:

1. Two-post automotive lift

C. Product Data Submittals: For each product.

1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

1.2 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: to include in operation and maintenance manuals.

1.3 WARRANTY

- A. Special Warranties: Manufacturer agrees to repair or replace automotive lift or components that fail in materials or workmanship within specified warranty period[.][except as qualified below:]

1. Warranty Period: [Five] years from date of Substantial Completion.
2. .

PART 2 - PRODUCTS

BASIS OF DESIGN: MOHAWK MODEL LC-12

1.0 SCOPE

- 1.1 THIS SPECIFICATION SETS FORTH THE CUSTOMERS' REQUIREMENTS FOR THE PURCHASE OF A HEAVY DUTY TWO-POST, FRAME CONTACT, ABOVE GROUND LIFT DESIGNED FOR LIFTING VEHICLES WEIGHING UP TO 12,000 LBS. THIS IS THE ONLY TYPE OF LIFT THAT WILL BE ACCEPTED.

- 1.1.1 PER ANSI STANDARD ANIS/ALI ALCTV-2011; OVERLOADING SWING ARMS IS NOT RECOMMENDED. AS A 12,000 LB. CAPACITY LIFT, MAXIMUM CAPACITY PER ARM EQUALS 3,000 LBS. EXERCISE CAUTION AS SOME (i.e.) 12,000 LB. VEHICLES MAY WEIGH OVER 7,000 LBS. ON REAR AXLE.
- 1.1.2 ALL EQUIPMENT SHALL BE NEW AND UNUSED. THE MODEL BEING BID MUST BE THE MANUFACTURER'S CURRENT PRODUCTION MODEL. USED, RECONDITIONED, LEFT OVER OR DISCONTINUED MODELS WILL NOT BE ACCEPTED.
- 1.1.3 EQUIPMENT MUST COMPLY WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL REGULATIONS AND MEET OSHA, UL-201, NEC, AND THE LATEST ANSI STANDARD.
- 1.1.4 EQUIPMENT MUST BE SUPPLIED WITH ALL ANSI, ALI SAFETY BOOKLET, ANSI OPERATIONS, INSTALLATION, AND MAINTENANCE BOOKLETS, ANSI/ALI ALOIM STANDARD AND LIFTING POINT GUIDES.
- 1.1.5 EQUIPMENT MUST BE SUPPLIED WITH ALL ANSI, ALI SAFETY DECALS. DECALS MUST BE PERMANENTLY PLACED ON THE LIFT IN CLEAR VIEW FOR THE OPERATOR.
- 1.2 THE MANUFACTURER MUST BE A FIRM REGULARLY ENGAGED IN THE DESIGN AND MANUFACTURING OF THE TYPE OF EQUIPMENT SPECIFIED HEREIN FOR A MINIMUM OF 5 YEARS, MANUFACTURING TWO POST LIFTS.
- 1.2.2 ON REQUEST, THE BUYER MUST RECEIVE A CURRENT USERS LIST FOR THE SPECIFIED STYLE AND LIFT CAPACITY.
- 1.3 ALL MATERIAL THICKNESS AND STRUCTURAL DIMENSIONS ARE MINIMUMS DIMENSIONAL TOLERANCES UNLESS NOTED AS FOLLOWS; ± 0.25 INCHES FOR DIMENSIONS LESS THAN 10 INCHES; ± 1.0 INCHES FOR DIMENSIONS FROM 10 INCHES TO 5 FEET INCLUSIVE; ± 3.0 INCHES FOR DIMENSIONS GREATER THAN 5 FEET.

2.0 LIFT

- 2.1 COMPLETE LIFT ASSEMBLY SHALL CONSIST OF AN ELECTRIC OVER HYDRAULIC LIFT UNIT, CONTROLS, ANY ACCESSORIES AS SPECIFIED HEREIN.
- 2.2 LIFTING CAPACITY WILL BE 12,000 LBS. MINIMUM.
- 2.3 LIFTING STROKE WILL BE 72" MINIMUM. THIS DIMENSION IS MEASURED FROM THE FLOOR TO UNDERNEATH THE SWING ARM WHEN THE LIFT IS AT FULL HEIGHT. MEASUREMENT TO THE TOP OF THE SWING ARM SHALL NOT BE ADDED TO THE VERTICAL TRAVEL TO ARRIVE AT LIFTING STROKE.
- 2.3.1 LIFTING HEIGHT WILL BE 77" MINIMUM. THIS MEASUREMENT IS MEASURED FROM THE FLOOR TO THE TOP OF THE LIFTING PAD WHEN THE LIFT IS AT FULL HEIGHT AND THE LIFTING PAD IS AT ITS LOWEST POSITION. (76-1/2" FOR LC-12-3SA)
- 2.3.2 LIFTING HEIGHT WILL BE 82" MINIMUM WITH 5" TRUCK ADAPTER, 87" MINIMUM WITH 10" TRUCK ADAPTER WHEN THE LIFT IS AT FULL HEIGHT. (81-1/2" AND 86-1/2" RESPECTIVELY FOR LC-12-3SA)

- 2.3.3 GRAVITY ACTIVATED LOCKS IN EACH COLUMN WORKING INDEPENDENTLY OF EACH OTHER SHALL START LOCKING AT A MINIMUM OF FIVE (5) INCHES OFF THE FLOOR. THE MECHANICAL LOCKS IN EACH COLUMN WILL ENGAGE EVERY THREE (4) INCHES THEREAFTER TO FULL LIFTING HEIGHT.
 - 2.3.3.1 LOCK BODY WILL BE MADE OF 1" THICK A-36 GRADE STEEL MEASURING 4"x6".
 - 2.3.3.2 EACH INDIVIDUAL LOCKING DEVICE SHALL BE CAPABLE OF SUPPORTING THE ENTIRE RATED LOAD OF THE LIFTING LEG.
 - 2.3.3.3 THE LOCKING MECHANISM SHALL BE MECHANICALLY OPERATED AND SHALL NORMALLY BE ENGAGING A LOCKED POSITION.
- 2.3.4 THE MECHANICAL LOCKS ARE RELEASED MANUALLY. THE MECHANICAL LOCKS WILL RE-ENGAGE AUTOMATICALLY EVERY TIME THE LIFT IS RAISED. THE MECHANICAL LOCKS SHALL ALLOW THE OPERATOR TO RELEASE THE LOCKS AND LOWER THE LIFT WITHOUT CONTINUING TO HOLD A LOCK RELEASE. AIR OPERATED LOCK RELEASE IS NOT ACCEPTABLE DUE TO RELIANCE ON COMPRESSED AIR SUPPLY.
- 2.4 LIFTING SPEED WILL BE 90 SECONDS MAXIMUM FROM THE FLOOR TO FULL HEIGHT.
- 2.5 LIFTING COLUMN
 - 2.5.1 EACH COLUMN WILL BE CONSTRUCTED OF 3/4-INCH "R-34" FORKLIFT CHANNEL AND BE RIGIDLY SUPPORTED AND JOINED TOGETHER WITH 3/4-INCH STEEL PLATE USING 3 POINT FILLET WELDS. FORMED, TUBULAR, OR BENT COLUMNS ARE NOT ACCEPTABLE.
 - 2.5.2 EACH COLUMN WILL BE A MINIMUM OF 19" WIDE X 9" DEEP. THESE LARGER HEAVY DUTY COLUMNS GIVE BETTER, SAFER SUPPORT WHEN LIFTING HEAVIER, UNEVEN LOADS. SMALLER LIGHTER DUTY COLUMNS WILL NOT BE ACCEPTED.
 - 2.5.3 EACH COLUMN WILL HAVE A BASE PLATE MADE FROM 3/4" THICK GRADE A-36 STEEL PLATES, MINIMUM. THE BASE PLATE WILL BE 29-1/2" X 23 3/4", MINIMUM. THIS LARGE BASE PLATE IS DESIGNED TO HAVE LESS THAN 50 PSI OF PRESSURE ON THE CONCRETE FLOOR WITH A FULL LOAD.
 - 2.5.3.1 EACH LIFT BASE PLATE WILL BE SECURED TO THE SHOP FLOOR USING EIGHT (8) 3/4" X 6" WEJ-IT BRAND ANCHOR BOLTS.
- 2.6 CARRIAGE ASSEMBLY
 - 2.6.1 EACH COLUMN WILL HAVE A CARRIAGE CONSTRUCTED OF 3/4- INCH STEEL PLATES JOINED TO A 3/8-INCH BACKING PLATE BY 3 POINT FILLET WELDS, MINIMUM.
 - 2.6.2 THE CARRIAGE ASSEMBLY WILL ROLL UP AND DOWN SMOOTHLY IN THE FORKLIFT MAST COLUMNS ON FOUR (4) 4 INCH DOUBLE SEALED SELF-LUBRICATING STEEL BALL BEARING ROLLERS. PLASTIC OR NYLON TYPE SLIDE BLOCKS AND BUSHING TYPE ROLLERS ARE NOT ACCEPTABLE.

- 2.6.3 THE CARRIAGE ASSEMBLY SHALL NOT REQUIRE ANY MONTHLY CLEANING WITH SOLVENTS OR ANY LUBRICATION. ALL WEAR SURFACES SHALL BE COMPLETELY SEALED & SELF LUBRICATING WITH NO GREASE REQUIREMENTS.
- 2.6.4 THE CARRIAGE WILL ALSO INCLUDE (4) 4 INCH DIAMETER DOUBLE SEALED SELF LUBRICATING STEEL BALL BEARING ROLLERS ACTING AS SIDE LOAD BEARINGS TO ELIMINATE THE STRESS OF UNEVENLY DISTRIBUTED LOADS. PLASTIC OR NYLON TYPE BEARINGS OR SLIDE BLOCKS ARE NOT ACCEPTABLE
- 2.6.5 THE CARRIAGE WILL BE LIFTED BY 1 1/2" WIDE #BL-844 LEAF CHAIN (MINIMUM), ROLLING OVER TWO (2) DOUBLE SEALED SELF-LUBRICATING CHAIN BEARINGS. SINGLE CHAIN BEARING AND BUSHING TYPE ROLLERS ARE NOT ACCEPTABLE.
- 2.6.6 CARRIAGES WILL SUPPORT THE SWING ARMS BY SANDWICHING THEM IN BETWEEN 2 PIECES OF 3/4 - INCH STEEL PLATE THAT IS JOINED TOGETHER BY 3 POINT FILLET WELDS. THE SWING ARMS WILL BE HELD IN PLACE BY A 1- 3/8 INCH DIAMETER STEEL PIN WITH NYLON LOCK NUTS ON EACH SIDE. SWING ARMS THAT ARE NOT SUPPORTED BY A "TOP PLATE AND BOTTOM PLATE" ON THE CARRIAGE ARE NOT ACCEPTABLE DUE TO UNACCEPTABLE FLEX AND BEING PRONE TO PREMATURE WEAR.
- 2.7 LIFTING ARMS
 - 2.7.1 MINIMUM ARM HEIGHT FROM FLOOR TO TOP OF LIFTING PAD IS 4 1/2" FOR LC-12 AND 5 INCH FOR LC-12-3SA.
 - 2.7.2 LIFTING ARMS WILL BE A CONSTRUCTED OF TWO PIECES (3 PIECES FOR LC-12-3SA) OF GRADE A-500-B STRUCTURAL TUBING. THIS TUBING MUST HAVE A MINIMUM TENSILE STRENGTH OF 75,000 PSI AND MINIMUM YIELD STRENGTH OF 60,000 PSI.
 - 2.7.3 THE FIRST PIECE CALLED "SWING ARM" WILL BE MADE OF 4" X 6" X 1/4" WALL THICKNESS. THE SECOND PIECE CALLED "SLIDER" WILL BE MADE FROM 3" X 5" X 3/8" THICK WALL. THE THIRD PIECE CALLED "SLIDER", FOR THE LC-12-3SA ONLY, WILL BE MADE FROM 2" X 4" X 3/8" THICK WALL. SLIDER ENDS SHALL BE CAP WELDED CLOSED ON BOTH ENDS FOR ADDED STRENGTH.
 - 2.7.4 LIFTING ARMS WILL ACCOMMODATE THE SMALLEST OF COMPACT CARS THROUGH LIGHT DUTY TRUCKS AND VANS WEIGHING UP TO 12,000 LBS.
 - 2.7.5 LIFTING ARMS WILL HAVE A CLOSED REACH OF 36-1/8" AND AN OPEN REACH OF 54". (36-3/8" AND 59" RESPECTIVELY FOR LC-12-3SA). ALL FOUR LIFTING ARMS WILL BE EQUAL IN LENGTH TO SAFELY SUPPORT FRONT WHEEL DRIVE VEHICLES AS WELL AS VEHICLES WITH DUAL REAR WHEELS, LIFT GATES, DUMP BODY AND UTILITY BODIES. ASYMMETRICAL LIFT ARMS ARE NOT ACCEPTABLE DUE TO UNACCEPTABLE FLEX OF LONGER REAR ARMS.
 - 2.7.6 LIFTING ARMS WILL BE EQUIPPED WITH ARM RESTRAINTS THAT OPERATE AUTOMATICALLY. MANUALLY OPERATED ARM RESTRAINTS ARE NOT ACCEPTABLE.
 - 2.7.7 SWING ARM RESTRAINTS WILL BE MADE FROM 1" DIAMETER HEAT TREATED ROCKWELL HARDNESS 50/55 GRADE 8 STEEL PINS THAT SLIDE THROUGH THE CARRIAGE AND ARE FORCED DOWNWARD BY A TENSIONING SPRING. THE TENSIONING SPRING FORCES THE PIN TO WEDGE AGAINST THE SWING ARM

SECURING IT IN PLACE. THE SWING ARMS AUTOMATICALLY SECURE THEMSELVES WHEN THE LIFT IS RAISED AND RELEASE AUTOMATICALLY WHEN THE LIFT IS LOWERED ALL THE WAY DOWN.

- 2.7.7.1 ARM RESTRAINTS WILL BE OF AN INFINITE POSITION DESIGN CAUSING ARMS TO BE HELD IN PLACE AT EVERY POINT IN THEIR ROTATION. GEARED TEETH TYPE ARM RESTRAINTS ARE NOT ACCEPTABLE DUE TO FINITE POSITION RESTRAINT LOCATIONS AND CHIPPED GEARS FOUND ON THIS DESIGN WHICH WHEN "CHIPPED" CAUSE ARMS TO NOT HOLD POSITION.
- 2.7.8 LIFTING PADS WILL BE MADE FROM 4-1/2" X 6" STEEL PLATE WITH STEEL CORRUGATED SURFACE FOR POSITIVE GRIPPING ON FLAT SURFACES OR LIFTING BY UNIBODY PINCH WELDS. RUBBER OR PLASTIC LIFTING PADS ARE NOT ACCEPTABLE DUE TO WEAR AND DECREASE CO-EFFICIENT OF FRICTION AS RUBBER PADS GET OILY.
- 2.7.9 LIFT PADS MUST HAVE A 4-1/2" X 6" LIFTING SURFACE AT ALL TIMES INCLUDING WHEN TRUCK ADAPTERS ARE IN USE. SMALLER LIFTING SURFACES SUCH AS FLIP-UP PADS ARE NOT ACCEPTABLE.
- 2.8 LIFT DIMENSIONS
 - 2.8.1 COLUMN HEIGHT 8'7" MAXIMUM
 - 2.8.2 HYDRAULIC LINE HEIGHT SET AT TWELVE (12) FOOT STANDARD HEIGHT; ADJUSTABLE TO ACCOMMODATE ANY CEILING HEIGHT. LIFTS WITH OVERHEAD CABLE COVERS THAT REQUIRE AN ELECTRICAL SAFETY SHUT-OFF SWITCH ARE NOT ACCEPTABLE.
 - 2.8.3 OPTIONAL IN-FLOOR HYDRAULIC LINES ROUTED IN THE CONCRETE SLAB USING SEAMLESS STAINLESS STEEL HYDRAULIC LINES. THIS FEATURE LEAVES NO OVERHEAD LINES ALLOWING FOR TALLER VEHICLES TO BE LIFTED THE FULL 6' LIFTING HEIGHT AND OVERHEAD CRANES TO MOVE FREELY AROUND THE LIFT.
 - 2.8.4 WIDTH BETWEEN COLUMNS WILL BE TEN (10) FOOT STANDARD, MINIMUM. WIDTH CAN BE ADJUSTABLE TO ACCOMMODATE WIDER VEHICLES OR NARROWED FOR TIGHT BAYS.
 - 2.8.4.1 WHEN INSTALLED AT 10' INSIDE DIMENSION SWING ARM SLIDERS WILL TOUCH IN CENTER ASSURING GREATEST POSSIBLE WHEELBASE VARIETY FOR LIFT.
 - 2.8.5 WIDTH BETWEEN LIFTING ARMS 8'-10" MINIMUM; ADJUSTABLE TO ACCOMMODATE WIDER VEHICLES.
 - 2.8.6 PAD HEIGHT 5" AT LOWEST POSITION WHEN THE LIFT IS ALL THE WAY DOWN. (4-1/2" FOR LC-12-3SA)
 - 2.8.7 LIFTING HEIGHT 77" AT THE TOP OF THE PAD AT FULL LIFTING HEIGHT. (76-1/2" FOR LC-12-3SA)
 - 2.8.8 LIFTING HEIGHT WITH 5" TRUCK ADAPTERS 82" AT FULL LIFTING HEIGHT. (81-1/2" FOR LC-12-3SA)
 - 2.8.9 LIFTING HEIGHT WITH 10" TRUCK ADAPTERS 87" AT FULL LIFTING HEIGHT. (86-1/2" FOR LC-12-3SA)

3.0 HYDRAULICS

- 3.1 THE LIFT SHALL INCORPORATE A MASTER / SLAVE HYDRAULIC SYSTEM WHICH SYNCHRONIZES ELEVATIONS DURING BOTH RAISING AND LOWERING OPERATIONS WITH THE MOST ADVERSE RATED LOAD PLACED ON THE LIFT. THE LIFT SHALL COME EQUIPPED WITH A FULLY AUTOMATIC LEVELING CONTROL AND MANUAL OVER-RIDE AS A BACK UP. CHAIN OR CABLE EQUALIZED LIFTS ARE NOT ACCEPTABLE.
- 3.2 INTERNAL HYDRAULIC SAFETIES ON BOTH CYLINDERS SHALL DETECT MAINSIDE TO OFFSIDE PRESSURE DIFFERENTIALS OF LESS THAN 200 LBS. SHOULD THE LIFTS PRESSURE CHANGE OR AN IMBALANCE CONDITION OCCUR FOR ANY REASON, THE LIFT WILL HYDRAULICALLY LOCK ON BOTH SIDES.
- 3.3 HYDRAULIC CYLINDERS WILL BE MADE OF 2-5/8" CHROME ROD. THE OVERSIZED CHROME ROD WILL BE PACKED IN A 4" BARREL, MINIMUM.
- 3.4 FULL LOAD WORKING PRESSURE WILL BE A MAXIMUM OF 3,100 PSI. HIGHER PRESSURE SYSTEMS WILL NOT BE ACCEPTED DUE TO HIGHER PRESSURES CAUSING SEAL LEAKAGE, PREMATURE POWER UNIT FAILURE AND CYLINDER WEAR.
- 3.5 CYLINDER PACKING CONSISTS OF THE FOLLOWING PARKER BRAND SEALS:
 - DYNAMIC PISTON T - SEALS
 - 2 BACK UP RINGS
 - 2 STATIC O-RINGS
 - ROD WIPER
 - ROD T - SEALS
- 3.6 LIFT WILL BE EQUIPPED WITH EXTERNAL HYDRAULIC SAFETIES CONSISTING OF VELOCITY FUSES MOUNTED ON EACH CYLINDER WHICH HYDRAULICALLY LOCK IN THE EVENT OF A LEAK, PLUS A FACTORY SET PRESSURE COMPENSATED FLOW CONTROL VALVE TO LIMIT DESCENT SPEED.
- 3.7 SEAMLESS STAINLESS STEEL HYDRAULIC TUBING WITH A BURST RATING OF 14,000 PSI, MINIMUM. RUBBER, STEEL BRAIDED, OR PLASTIC HYDRAULIC HOSES ARE NOT ACCEPTABLE.
- 3.8 ALL HYDRAULIC FITTINGS WILL BE STANDARD JIC OR O-RING BOSS FITTINGS. SELF FLARING OR COMPRESSION FITTINGS ARE NOT ACCEPTABLE.
- 3.9 HYDRAULIC FLUID WILL BE DEXRON III, ATF.

4.0 POWER UNIT

- 4.1 POWER UNIT CAN BE MOUNTED ON EITHER DRIVER SIDE OR PASSENGER SIDE COLUMN AND WILL CONSIST OF:
 - ELECTRIC MOTOR
 - HYDRAULIC PUMP
 - STEEL OIL RESERVOIR (PLASTIC RESERVOIRS NOT ACCEPTABLE)
 - SUCTION STRAINER
 - HYDRAULIC GEAR PUMP
 - ALL HYDRAULIC VALVING

- 4.1.1 ELECTRIC MOTOR IS 2 H.P. MINIMUM, 208VAC / 230VAC, 1 PHASE, 60 HZ. THE MOTOR WILL HAVE MAXIMUM FULL AMP LOADS OF 17.4 AMPS @ 208V AND 14.6 AMPS @ 230V.
- 4.1.2 HYDRAULIC PUMP IS A PRESSURE BALANCED GEAR PUMP WITH FIXED DISPLACEMENT, EXTERNAL TOOTH, AND ALL STEEL GEARS. THE PUMP MUST BE EXTREMELY TOLERANT OF FLUID CONTAMINANTS AND RESISTANT TO GALLING CAUSED BY LOW VISCOSITY START-UP. HARDCOAT PROCESSED INTERNAL PUMP SURFACES FOR EXTENDED SERVICE LIFE.
- 4.1.3 THE CONTROLS SHALL BE COLUMN MOUNTED WITH THE UNIT OPERATED BY A PUSH UP SWITCH AND A MANUAL DOWN LEVER.

5.0 WARRANTY

- 5.1 WARRANTY ON ALL STRUCTURAL COMPONENTS (LEGS, CARRIAGES, SWING ARMS AND SLIDERS) IS A FULL 25 YEARS. (SEE 5.5)
- 5.2 WARRANTY ON MECHANICAL COMPONENTS (ROLLER BEARINGS AND LIFTING CHAIN) IS A FULL 10 YEARS. (SEE 5.5)
- 5.3 WARRANTY ON ALL POWER UNIT COMPONENTS (MOTOR, PUMP AND RESERVOIR) IS A FULL 2 YEARS. (SEE 5.5)
- 5.4 HYDRAULIC CYLINDERS ARE COVERED BY AN INITIAL 5 YEAR WARRANTY, THEN AN EXTENDED CYLINDER SEAL WARRANTY THEREAFTER. (SEE 5.5)
- 5.5 FOR SPECIFICS AND COMPLETE BREAKDOWN OF WARRANTY STATEMENT AND POLICY, SEE MOHAWK WARRANTY ON LIST PRICE SHEET.

6.0 STANDARD EQUIPMENT

- 6.1 TRUCK ADAPTERS, (4) 5", (4) 7 1/2" AND (4) 10". FLIP TYPE AND SCREW TYPE PADS ARE NOT ACCEPTABLE DUE TO LONGER SET UP TIME, HIGHER ARM PAD HEIGHTS OR SMALLER LIFT PAD CONTACT SURFACE.
- 6.2 MALE AND FEMALE ELECTRICAL HUBBELL PLUGS, MALE PLUG PREWIRED ON LIFT WITH FEMALE PLUG IN PARTS BOX.
- 6.3 (16) 3/4" X 6" WEJ-IT ANCHOR BOLTS.
- 6.4 DEXRON III ATF HYDRAULIC FLUID FOR HYDRAULIC PUMP AND RESERVOIR.
- 6.5 SHIMS TO LEVEL THE COLUMNS FOR PROPER INSTALLATION.
- 6.6 SAFETY AND OPERATIONS MANUAL.
 - 6.6.1 ANSI/ALI OIM BOOKLET (ALI STANDARD # ALOIM-2008).
 - 6.6.2 ANSI/ALI LIFTING IT RIGHT BOOKLET (ALI STANDARD # SM01-2).
 - 6.6.3 ANSI/ALI LIFTING POINT GUIDE BOOKLET (ALI STANDARD # ALI/LP-GUIDE).
 - 6.6.4 ANSI/ALI SAFETY DECALS AFFIXED TO LIFT.

PART 3 -
PART 4 - EXECUTION

4.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

4.2 INSTALLATION

- A. Install vehicle lift according to manufacturer's written instructions.
- B. Securely anchor lift per manufacturer's written instructions. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

END OF SECTION 11 00 00

SECTION 11 30 13
RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Cooking appliances.
 2. Kitchen exhaust ventilation.
 3. Refrigeration appliances.
 4. Cleaning appliances.

ACTION SUBMITTALS

- B. Product Data:
1. Cooking appliances.
 2. Kitchen exhaust ventilation.
 3. Refrigeration appliances.
 4. Cleaning appliances.
- C. Product Data Submittals: For each product.
1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- D. Product Schedule: For appliances.[Use same designations indicated on Drawings.]

1.2 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.3 WARRANTY

- A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period[.][except as qualified below:]
1. Warranty Period: [Five] years from date of Substantial Completion.
 2. .

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain [residential appliances from single source] [and] [each type of residential appliance from single manufacturer].

2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in [the current editions of the Florida Building Code – Accessibility]
- C. Electric Range: [Freestanding] range with [one] oven(s) and complying with AHAM ER-1.
 - 1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Frigidaire]
 - b. [GE Appliances; Haier Group]
 - c. [Kenmore]
 - d. [KitchenAid; Whirlpool Corporation]
 - e. [LG Electronics USA, Inc.; LG Electronics Inc.]
 - f. [Maytag; Whirlpool Corporation]
 - g. [Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC)]
 - h. [Whirlpool Corporation]
 - 2. Width:<As indicated on Drawings>.
 - 3. Electric Burner Elements: [Four].
 - a. Radiant Type: [Manufacturer's standard]
 - b. Controls: Digital panel controls, located on [front]
 - 4. Oven Features:
 - a. Capacity: [3.3 cu. ft.] Minimum
 - b. Operation: [Baking] [convection] [and] [pyrolytic self-cleaning or catalytic continuous cleaning]
 - c. Broiler: Located in [top of oven]
 - d. Oven Door(s): Counterbalanced, removable, with [observation window] [and] [full-width] handle.
 - e. Electric Power Rating:

- 1) Oven(s): [Manufacturer's standard]
 - 2) Broiler: [Manufacturer's standard]
 - f. Controls: Digital panel controls and timer display, located on [front]
 5. Anti-Tip Device: Manufacturer's standard.
 6. Electric Power Supply: [As indicated on Drawings]
 7. Material:[Stainless] steel with [manufacturer's standard cooktop.
- D. Microwave Oven:
1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Frigidaire]
 - b. [GE Appliances; Haier Group]
 - c. [Kenmore]
 - d. [KitchenAid; Whirlpool Corporation]
 - e. [LG Electronics USA, Inc.; LG Electronics Inc.]
 - f. [Maytag; Whirlpool Corporation]
 - g. [Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC)]
 - h. [Whirlpool Corporation]
 2. Mounting: <As indicated on Drawings>.
 3. Type: [Conventional]
 4. Dimensions:
 - a. Width: [As indicated on Drawings]
 - b. Depth: [As indicated on Drawings]
 - c. Height: [As indicated on Drawings]
 5. Capacity: [2.0 cu. ft.]
 6. Oven Door: Door with observation window [and pull handle] [and pushbutton latch release].
 7. Microwave Power Rating: [Manufacturer's standard]
 8. Electric Power Supply:[As indicated on Drawings]
 9. Controls: Digital panel controls and timer display.
 10. Other Features: [Turntable]
 11. Material: [Stainless steel]

2.3 KITCHEN EXHAUST VENTILATION

A. Overhead Exhaust Hood:

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

- a. [Frigidaire]
 - b. [GE Appliances; Haier Group]
 - c. [Kenmore]
 - d. [KitchenAid; Whirlpool Corporation]
 - e. [LG Electronics USA, Inc.; LG Electronics Inc.]
 - f. [Maytag; Whirlpool Corporation]
 - g. [Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC)]
 - h. [Whirlpool Corporation]
2. Type: [Wall-mounted,] exhaust-hood system.
 3. Dimensions:
 - a. Width: [As indicated on Drawings]
 - b. Depth: [As indicated on Drawings]
 4. Exhaust Fan: [Variable] or [Three]-speed fan [built into hood] and with [manufacturer's standard] capacity.
 - a. Venting: [Vented to outside through roof with weatherproof roof cap, backdraft damper, and rodent-proof screening] or [Vented to outside through wall with weatherproof wall cap, backdraft damper, and rodent-proof screening]
 - b. Fan Control: [Hood]-mounted[touch-pad to control] fan switch, with separate hood-light control switch.
 5. Duct Type: [Manufacturer's standard]
 6. Finish: [Stainless steel]
 7. Features:
 - a. Permanent, washable [stainless steel-mesh] filter(s).
 - b. Built-in [LED] lighting.
 - c. Warming lamp socket(s).

2.4 REFRIGERATION APPLIANCES

- A. Refrigerator/Freezer: [Two-door, side-by-side refrigerator/freezer] and complying with AHAM HRF-1.
 1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Frigidaire]
 - b. [GE Appliances; Haier Group]
 - c. [Kenmore]
 - d. [KitchenAid; Whirlpool Corporation]
 - e. [LG Electronics USA, Inc.; LG Electronics Inc.]
 - f. [Maytag; Whirlpool Corporation]
 - g. [Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd.]

- h. (SEC)
[Whirlpool Corporation]
- 2. Type: [Freestanding]
- 3. Dimensions:
 - a. Width: [As indicated on Drawings]
 - b. Depth: [As indicated on Drawings]
 - c. Height: [As indicated on Drawings]
- 4. Storage Capacity:
 - a. Refrigeration Compartment Volume: [15.6 cu. ft.] min.
 - b. Freezer Volume: [5.13 cu. ft.] min.
 - c. Shelf Area: [Three] adjustable [glass] shelves, [26 sq. ft.] min.
- 5. General Features:
 - a. Door Configuration: [Overlay].
 - b. Built-in water-filtration system.
 - c. Dual refrigeration systems.
- 6. Refrigerator Features:
 - a. Interior light in refrigeration compartment.
 - b. Compartment Storage: [vegetable crisper] [and] [meat compartment]
 - c. Door Storage: [Modular compartments] [1 gal. milk-container storage] .
 - d. Temperature-controlled meat/deli bin.
- 7. Freezer Features: [One] freezer compartment(s) [with door(s)]
 - a. [Automatic] defrost.
 - b. Interior light in freezer compartment.
 - c. Automatic icemaker and storage bin.
- 8. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.
- 9. Front Panel(s): [Stainless steel]
- 10. Appliance Color/Finish:[Stainless steel]

2.5 CLEANING APPLIANCES

A. Dishwasher: Complying with AHAM DW-1.

- 1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Frigidaire]
 - b. [GE Appliances; Haier Group]

- c. [Kenmore]
 - d. [KitchenAid; Whirlpool Corporation]
 - e. [LG Electronics USA, Inc.; LG Electronics Inc.]
 - f. [Maytag; Whirlpool Corporation]
 - g. [Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC)]
 - h. [Whirlpool Corporation]
 2. Type: [Built-in undercounter]
 3. Dimensions:
 - a. Width: [As indicated on Drawings]
 - b. Depth: [As indicated on Drawings]
 - c. Height: [As indicated on Drawings]
 4. Capacity:
 - a. International Place Settings of China: [Eight]
 - b. Water Consumption for Full Load: [3.2 gal.] max. per cycle.
 5. Sound Level: Maximum [42] dB.
 6. Tub and Door Liner: [Stainless steel] with sealed detergent and automatic rinsing-aid dispensers.
 7. Rack System: [Nylon] or [PVC]-coated sliding dish racks, with [removable cutlery basket] [top cutlery tray]
 8. Controls: [Touch-pad] controls with [four] wash cycles and hot-air and heat-off drying cycle options.
 9. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.
 10. Front Panel: [Stainless steel]
 11. Appliance Color/Finish:[Stainless steel]
- B. Clothes Washer: Complying with AHAM HLW-1.
1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Frigidaire]
 - b. [GE Appliances; Haier Group]
 - c. [Kenmore]
 - d. [KitchenAid; Whirlpool Corporation]
 - e. [LG Electronics USA, Inc.; LG Electronics Inc.]
 - f. [Maytag; Whirlpool Corporation]
 - g. [Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC)]
 - h. [Whirlpool Corporation]
 2. Type: [Freestanding] [Stacking] [Undercounter], [top] [front]-loading unit.
 3. Dimensions:

- a. Width: [As indicated on Drawings]
 - b. Depth: [As indicated on Drawings]
 - c. Height: [As indicated on Drawings]
4. Drum: [Perforated stainless steel]
 - a. Capacity: [3.2 cu. ft.] min.
 5. Controls: [Touchpad] or [Rotary-dial] controls for water-fill levels, wash/rinse water temperatures, and variable-speed and fabric selectors.
 - a. Wash Cycles: [Six] [wash cycles, including regular, delicate, and permanent press.
 - b. Wash Temperatures: [Three] settings.
 - c. Speed Combinations: [Four]
 6. Electrical Power: [As indicated on Drawings]
 7. Motor: Manufacturer's standard with built-in overload protector.
 8. Features:
 - a. Self-leveling legs.
 - b. Pedestal: [Manufacturer's standard height] laundry pedestal with storage drawer, matching appliance finish.
 9. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.
 10. Water-Efficient Clothes Washer: Provide clothes washer with modified energy factor greater than or equal to 2.0 and water factor less than 5.5.
 11. Appliance Finish [Stainless steel]
 12. Front-Panel Finish: [Stainless steel]
- C. Clothes Dryer: Complying with AHAM HLD-1.
1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Frigidaire]
 - b. [GE Appliances; Haier Group]
 - c. [Kenmore]
 - d. [KitchenAid; Whirlpool Corporation]
 - e. [LG Electronics USA, Inc.; LG Electronics Inc.]
 - f. [Maytag; Whirlpool Corporation]
 - g. [Samsung Electronics America, Inc. (SEA); Samsung Electronics Co., Ltd. (SEC)]
 - h. [Whirlpool Corporation]
 2. Type: [Freestanding] [Stacking] [Undercounter], frontloading, [gas] [electric] [electric, ventless] unit.
 3. Dimensions:

- a. Width: [As indicated on Drawings]
 - b. Depth: [As indicated on Drawings]
 - c. Height: [As indicated on Drawings]
4. Drum: [Perforated stainless steel]
- a. Capacity: [5.7 cu. ft.] min.
5. Controls: [Touchpad] or [Rotary-dial] controls for drying cycle, temperatures, and fabric selectors.
6. Electric-Dryer Power: [As indicated on Drawings]
7. Features:
- a. Removable lint filter.
 - b. Electronic temperature and moisture-level-sensor controls.
 - c. End-of-cycle signal.
 - d. Interior drum light.
 - e. Self-leveling legs.
 - f. Pedestal: [Manufacturer's standard height] laundry pedestal with storage drawer, matching appliance finish.
8. Appliance Finish: [Stainless steel]
9. Front-Panel Finish: [Stainless steel]

2.6 GENERAL FINISH REQUIREMENTS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.
- C. Examine walls, ceilings, and roofs for suitable conditions where [overhead exhaust hoods] will be installed.
- D. Prepare written report, endorsed by Installer, listing conditions detrimental to

performance of the Work.

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

3.2 INSTALLATION

- A. Install appliances according to manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

END OF SECTION 113013

SECTION 12 21 13
HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Horizontal louver blinds, aluminum slats.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Horizontal louver blinds, aluminum slats.
- B. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type and color of horizontal louver blind.
 - 1. Include Samples of accessories involving color selection.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation, using same designations indicated on Drawings.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet-work and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.5 WARRANTY

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

1. Failures include, but are not limited to, the following:
 - a. Faulty operation of motorized operating system components.
2. Warranty Period: **[5]** year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain horizontal louver blinds from single source from single manufacturer.

2.2 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS

- 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. **[Hunter Douglas Architectural]**
 2. **[Hunter Douglas Architectural Window Coverings]**
- B. Slats: Aluminum; alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radius corners.
 1. Width: **[1 inch]**.
 2. Thickness: **[Manufacturer's standard]**.
 3. Spacing: **[Manufacturer's standard]**.
 4. Finish: **[Ionized antistatic, dust-repellent, baked polyester finish]**.
- C. Manual Cordless Operation:
 1. Lift Mechanism: Manufacturer's standard lift- or tension-control mechanism that allows blinds to be raised or lowered into position by manually pushing the bottom rail up or pulling it down.
 2. Lift Operator: **[Manufacturer's standard]**.
 3. Tilt Mechanism: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.
 4. Tilt Position:
 - a. Full.
 5. Tilt Operator: **[Corrosion-resistant steel rod]**.
 6. Tilt Over-Rotation Protection: Manufacturer's detachable operator or slip clutch to prevent over-rotation of gear.
 7. Tilt-Operator Length: **[36 inches]**.
 8. Tilt-Operator Location: **[Manufacturer's standard]** unless otherwise indicated.
- D. Bottom Rail: Formed-steel or extruded-aluminum tube that secures and protects ends

of ladders and inner lift cords and has plastic- or metal-capped ends.

1. Type: **[Manufacturer's standard]**

E. Valance: **[Manufacturer's standard]**.

F. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.

1. Type: **[Wall] [Overhead] [End]**.

2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by horizontal louver blind manufacturer for weight and size of blind.

G. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard.

H. Side Channels and Perimeter Light Gap Seals: Manufacturer's standard.

I. Colors, Textures, Patterns, and Gloss:

1. Slats: **[As selected by Architect from manufacturer's full range]**.

2. Components: **[Provide rails, cords, ladders, and materials exposed to view matching or coordinating with slat color unless otherwise indicated]**.

2.3 FABRICATION OF HORIZONTAL LOUVER BLINDS

A. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at **74 deg F**:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less **1/4 inch** per side or **1/2 inch** total, plus or minus **1/8 inch**. Length equal to head-to-sill dimension of opening in which blind is installed less **1/4 inch**, plus or minus **1/8 inch**.

2. Outside of Jamb Installation: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.

C. Mounting Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind mounting method indicated.

D. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

E. Color-Coated Finish:

1. Metal: For components exposed to view, unless anodized or plated finish is indicated, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION OF HORIZONTAL LOUVER BLINDS

- A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units in accordance with manufacturer's written instructions.
 1. Locate so exterior slat edges are not closer than [1 inch] from interior faces of glass and not closer than [1/2 inch] from interior faces of glazing frames through full operating ranges of blinds.
 2. Install mounting brackets to prevent deflection of headrails.
 3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.3 ADJUSTING

- A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

- A. Clean horizontal louver blind surfaces after installation in accordance with manufacturer's written instructions.
- B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

END OF SECTION 12 21 13

SECTION 12 32 16
MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic-laminate-clad casework.
 - 2. Hardware and accessories.

1.2 DEFINITIONS

- A. Definitions in the AWI/AWMAC/WI's "Architectural Woodwork Standards" apply to the Work of this Section.

1.3 COORDINATION

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

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. Plastic-laminate-clad casework.
 - 2. Hardware and accessories.
- B. Shop Drawings: For plastic-laminate-clad casework.
 - 1. Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required for installation.
 - 2. Indicate types and sizes of casework.
 - 3. Indicate manufacturer's catalog numbers for casework.
 - 4. Show fabrication details, including types and locations of hardware.
 - 5. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and equipment.
- C. Samples for Initial Selection: For casework and hardware finishes.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces during handling and installation with protective covering of

polyethylene film or other suitable material.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during remainder of construction period. [**Maintain temperature and relative humidity during remainder of construction period in range recommended for Project location by the AWI/AWMAC/WI's "Architectural Woodwork Standards."**]
- B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to established dimensions.
- C. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.
- D. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of components or other failures of glue bond.
 - b. Warping of components.
 - c. Failure of operating hardware.
 - 2. Warranty Period: [**Five**] years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR CASEWORK

- A. Quality Standard: Unless otherwise indicated, comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.
 - 1. Grade: [**Custom**]

B. Product Designations:

1. Drawings indicate sizes, configurations, and finish materials of manufactured plastic-laminate-clad casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish materials, and complying with the Specifications may be considered. See Section 01 60 00 "Product Requirements."
2. Drawings indicate configurations of manufactured plastic-laminate-clad casework by referencing designations of Casework Design Series numbering system in the Appendix of the AWI/AWMAC/WI's "Architectural Woodwork Standards."

2.2 PLASTIC-LAMINATE-CLAD CASEWORK

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. **[Advanced Cabinet Systems (ACS)]**
2. **[Case Systems Inc]**
3. **[R. C. Smith Company]**
4. **[Sidney Millwork Company]**
5. **[Stevens Industries, Inc.]**
6. **[TMI Systems Corporation]**
7. **[Windham Millwork, Inc]**

B. Source Limitations: Obtain from single source from single manufacturer.

C. Design: **[Frameless]** cabinet construction with the following door and drawer-front style:

1. Flush overlay.

D. Grain Direction for Wood-Grain Plastic Laminate:

1. Doors: Vertical with continuous vertical matching.
2. Drawer Fronts: **[Vertical with continuous vertical matching]**.
3. Face Frame Members: Lengthwise.
4. End Panels: Vertical.
5. Bottoms and Tops of Units: Side to side.
6. Knee Space Panels: Vertical.
7. Aprons: Horizontal.

E. Exposed Materials:

1. Plastic-Laminate Grade: Horizontal Surfaces **[HGS]** Vertical Surfaces **[VGS]**.
 - a. Colors and Patterns: **[As selected by Architect from manufacturer's full range]**
2. Edgebanding: **[PVC]**.

- a. PVC Edgebanding Color: [**As selected by Architect from casework manufacturer's full range**].

F. Semiexposed Materials:

1. Plastic Laminate: Grade VGS unless otherwise indicated. Provide plastic laminate for semi exposed surfaces unless otherwise indicated.
 - a. Colors and Patterns: [**As selected by Architect from manufacturer's full range**] .
 - b. Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.
2. Hardboard: Use only for cabinet backs where exterior side of back is not exposed.
3. Metal for Steel Drawer Pans: Cold-rolled, carbon-steel sheet complying with ASTM A1008/A1008M; matte finish; suitable for exposed applications.
4. Unless otherwise indicated, provide specified edge banding on all semi exposed edges.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware: Unless otherwise indicated, provide manufacturer's standard [**satin-finish**] , commercial-quality, heavy-duty hardware.
 1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.
- B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, Type B01602[, **self-closing**]. Provide two hinges for doors less than **48 inches** high and provide three hinges for doors more than **48 inches** high.
 1. Degrees of Opening:[**135**] degrees.
- C. Wire Pulls: Solid [**stainless steel**]wire pulls, fastened from back with two screws.
 1. Provide two pulls for drawers more than **24 inches** wide.
- D. Door Catches: [**dual, self-aligning, permanent magnet catch**]. Provide two catches on doors more than **48 inches** high.
- E. Door and Drawer Bumpers: Self-adhering, clear silicone rubber.
 1. Doors: Provide one bumper at top and bottom of closing edge of each swinging door.
 2. Drawers: Provide one bumper on back side of drawer front at each corner.
- F. Drawer Slides: ANSI/BHMA A156.9.
 1. Heavy Duty (Grade 1HD-100): [**Side mount**].
 - a. Type: [**Full overtravel**] extension.

- b. Material: [**Zinc-plated steel**] slides.
- c. Motion Feature: [**Self-closing mechanism**].
- 2. General-purpose drawers; provide [**100 lb**] load capacity.
- 3. File drawers; provide [**150 lb**] load capacity.
- G. Drawer and Hinged-Door Locks: [**Mortise**] type, five-pin tumbler, brass with chrome-plated finish, and complying with ANSI/BHMA A156.11, Grade 1.
 - 1. Provide a minimum of two keys per lock and six master keys.
 - 2. Provide locks [**where indicated**]

2.4 MATERIALS

- A. Composite Wood Products: Products shall be made without urea formaldehyde.
- B. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.
- C. Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated.
- D. Softwood Plywood: DOC PS 1.
- E. Particleboard: ANSI A208.1, Grade M-2.
- F. MDF: Medium-density fiberboard, ANSI A208.2, [**Grade 130**] .
- G. Hardboard: ANSI A135.4, Class 1 tempered.
- H. Plastic Laminate: High-pressure decorative laminate complying with ISO 4586-3.
 - 1. Manufacturers: Subject to compliance with requirements, [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
 - a. [**Formica Corporation**]
 - b. [**Laminart LLC**]
 - c. [**Nevamar Company, LLC**]
 - d. [**Pionite; a Panolam Industries International, Inc. brand**]
 - e. [**Wilsonart LLC**]
 - 2. Source Limitations: Obtain from single source from single manufacturer.
- I. PVC Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3.0 mm thick at doors and drawer fronts, 1.0 mm thick elsewhere.
- J. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.5 FABRICATION

- A. Plastic-Laminate-Clad Cabinet Construction: As required by referenced quality standard, but not less than the following:

1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: **3/4-inch** particleboard.
 2. Shelves: [**3/4-inch- thick plywood or 1-inch- thick particleboard**].
 3. Backs of Casework: **1/2-inch-** thick particleboard or MDF where exposed, [**1/4-inch- thick hardboard**] dadoed into sides, bottoms, and tops where not exposed.
 4. Drawer Fronts: **3/4-inch** particleboard.
 5. Drawer Bottoms: **1/4-inch-** thick [**hardwood plywood**] glued and dadoed into front, back, and sides of drawers. [**Use 1/2-inch material for drawers more than 24 inches wide.**]
 6. Drawer Bodies: Steel drawer pans formed from **0.0359-inch-** thick metal, metallic phosphate treated, and finished with manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat with a minimum dry film thickness of **1 mil** for topcoat and **2 mils** for system.
 7. Cabinet Doors:
 - a. 48 Inches (1220 mm) High or Less: **3/4 inch** thick, with particleboard or MDF cores.
 - b. 48 Inches (1220 mm) or More in Height: [**1-1/8 inches thick, with particleboard**] cores.
- B. Filler Strips: Provide as needed to close spaces between casework and walls, ceilings, and equipment. Fabricate from same material and with same finish as casework.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Grade: Install casework to comply with same quality standard grade as item to be installed.
- B. Install casework level, plumb, and true in line; shim as required using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
- C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within **1/16 inch** of a single plane. Align similar adjoining doors and drawers to a tolerance of **1/16 inch**. Bolt adjacent cabinets together with joints flush, tight, and uniform.
- D. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms

within **1/16 inch** of a single plane. Fasten cabinets to hanging strips, masonry, framing, wood blocking, or reinforcements in walls and partitions. Align similar adjoining doors to a tolerance of **1/16 inch**.

- E. Fasten casework to adjacent units and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards."
- F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.
- G. Adjust operating hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 CLEANING

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 12 32 16

SECTION 12 36 61.16
SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Solid surface material countertops.
 2. Solid surface material backsplashes.
 3. Solid surface material end splashes.

1.2 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Samples for Initial Selection: For each type of material exposed to view.

1.3 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements [**after base cabinets are installed but**] before countertop fabrication is complete.

1.4 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 ISFA 2-01.
1. Manufacturers: Subject to compliance with requirements, [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
 - a. [**DuPont; DuPont de Nemours, Inc.**]
 - b. [**Formica Corporation**]
 - c. [**LG Hausys, Ltd.**]
 - d. [**Swan Surfaces LLC (Swanstone)**]
 - e. [**Wilsonart LLC**]

2. Type: Provide Standard type [**or Veneer type made from material complying with requirements for Standard type, as indicated**] unless Special Purpose type is indicated.
 3. Colors and Patterns: [**As selected by Architect from manufacturer's full range**].
- B. Composite Wood Products: Products shall be made without urea formaldehyde.
- C. Particleboard: ANSI A208.1, [**Grade M-2-Exterior Glue**].
- D. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
1. Grade: [**Custom**].
- B. Configuration:
1. Front: [**Straight, slightly eased at top**]
 2. Backsplash: [**Straight, slightly eased at corner**]
 3. End Splash: [**Matching backsplash**].
- C. Countertops:
1. [**1/2-inch**] thick, solid surface material [**with front edge built up with same material**].
- D. Backsplashes: [**1/2-inch**] 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.
1. Fabricate with loose backsplashes for field assembly.
- F. Joints:
1. Fabricate countertops without joints.
 2. Fabricate countertops in sections for joining in field [, **with joints at locations indicated**].
 - a. Joint Locations: Not within **18 inches** of a sink or cooktop and not where a countertop section less than **36 inches** long would result, unless unavoidable.
- G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures [**in shop**] using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting **3/16 inch** into fixture opening.
 - b. Provide vertical edges, rounded to **3/8-inch** radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting **3/16 inch** into fixture opening.
 - c. Provide **3/4-inch** full bullnose edges projecting **3/8 inch** into fixture opening.
2. 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.
3. 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 07 92 00 "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, 1/4 inch** maximum. Do not exceed **1/64-inch** 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 [**where indicated**]. 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. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Pre-drill holes for screws as recommended by manufacturer.
- H. 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.
- I. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION 12 36 61.16

SECTION 22 05 19
METER AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pressure gauges and pressure gauge taps.
- B. Thermometers and thermometer wells

1.2 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.
- B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.
- C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014, with Editorial Revision (2017).
- D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.4 FIELD CONDITIONS

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.1 PRESSURE GAUGES

- A. Pressure Gauges: ASME B40.100, UL 393, stainless steel bourdon tube, rotary stainless steel movement, 316 stainless steel socket, with slotted adjustable pointer, black scale on white background.
 - 1. Case: high impact polypropylene.
 - 2. Size: 4-1/2-inch (115 mm) diameter.
 - 3. Mid-Scale Accuracy: 1/2 percent.
 - 4. Scale: Psi and kPa.

2.2 STEM TYPE THERMOMETERS

- A. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum

adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 9-inch (225 mm) scale.
2. Window: Clear glass.
3. Accuracy: 2 percent, per ASTM E77.
4. Calibration: Degrees F.

2.3 DIAL THERMOMETERS

- A. Thermometers - Adjustable Angle: Dial type bimetallic actuated; ASTM E1; stainless steel case, adjustable angle with front recalibration, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.
1. Size: 5-inch (125 mm) diameter dial.
 2. Lens: Clear glass.
 3. Accuracy: 1 percent.
 4. Calibration: Degrees F.

2.4 THERMOMETER SUPPORTS

- A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

2.5 TEST PLUGS

- A. Test Plug: 1/4-inch (6 mm) or 1/2-inch (13 mm) brass fitting and cap for receiving 1/8 inch (3 mm) outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F (93 degrees C).

PART 3: EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.
- C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch (60 mm) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- D. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Where thermometers are provided on local panels, duct or pipe mounted thermometers are provided on local panels, duct or pipe mounted thermometers are not required.
- E. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- F. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- G. Adjust gauges and thermometers to final angle, clean windows, and lenses, and calibrate to zero.
- H. Locate test plugs adjacent thermometers and thermometer sockets.

END OF SECTION 22 05 19

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1: GENERAL

1.1 SECTION INCLUDES

- A. Applications.
- B. Angle valves.
- C. Ball valves.
- D. Check valves.

1.2 RELATED REQUIREMENTS

- A. Section 22 0553 - Identification for Plumbing Piping and Equipment.
- B. Section 22 0719 - Plumbing Piping Insulation.
- C. Section 22 1005 - Plumbing Piping.

1.3 ABBREVIATIONS AND ACRONYMS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Non-rising stem.
- E. OS&Y: Outside screw and yoke.
- F. PTFE: Polytetrafluoroethylene.
- G. RS: Rising stem.
- H. SWP: Steam working pressure.
- I. TFE: Tetrafluoroethylene.
- J. WOG: Water, oil, and gas.

1.4 REFERENCE STANDARDS

- A. API STD 594 - Check Valves: Flanged, Lug Wafer, and Butt-Welding; 2017.
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.
- C. ASME B16.34 - Valves - Flanged, Threaded and Welding End; 2017
- D. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications; 2019.
- E. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2019).
- F. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).
- G. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.
- H. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.

- I. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.
- J. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
- K. NSF 61 - Drinking Water System Components - Health Effects; 2020.
- L. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.5 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.
- E. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.
 - 1. See Product Requirements, for additional provisions.

1.6 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Obtain valves for each valve type from single manufacturer.
 - 2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
 - 3. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
 - 2. Protect valve parts exposed to piped medium against rust and corrosion.
 - 3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
 - 4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection and protect flanges and specialties from dirt.
 - a. Provide temporary inlet and outlet caps.
 - b. Maintain caps in place until installation.

2. Store valves in shipping containers and maintain in place until installation.
 - a. Store valves indoors in dry environment.
 - b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

1.8 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING

- A. Handle large valves with sling, modified to avoid damage to exposed parts.
- B. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2: PRODUCTS

2.1 APPLICATIONS

- A. See drawings for specific valve locations.
 1. Provide the following valves for the applications if not indicated on drawings.
 - a. Shutoff: Ball, butterfly, gate or plug.
 - b. Throttling: Provide globe, angle, ball, or butterfly.
 - c. Swing Check (Pump Outlet):
 - d. 12 NPS (50 DN) and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
 - e. 2-1/2 NPS (65 DN) and Larger for Domestic Water: Iron swing check valves with closure control, metal, or resilient seat check valves.
 - f. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.
- B. Domestic, Hot and Cold-Water Valves:
 1. 2 NPS (50 DN) and Smaller:
 - a. Bronze and Brass: Provide with solder-joint ends.
 - b. Bronze Angle: Class 125, bronze disc.
 - c. Ball: One-piece, full port, brass with brass or stainless-steel trim.
 - d. Bronze Swing Check: Class 125, bronze disc.
 - e. Bronze Gate: Class 125, NRS.
 - f. Bronze Globe: Class 125, bronze disc.

2.2 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
 1. Valve Actuator Types:
 - a. Handwheel: Valves other than quarter-turn types.

- b. Hand Lever: Quarter-turn valves 6 NPS (150 DN) and smaller except plug valves.
- 2. Valves in Insulated Piping: With 2 NPS (50 DN) stem extensions and the following features:
 - a. Gate Valves: Rising stem.
 - b. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - c. Butterfly Valves: Extended neck.
 - d. Memory Stops: Fully adjustable after insulation is installed.
- 3. Valve-End Connections:
 - a. Solder Joint Connections: ASME B16.18.
- 4. General ASME Compliance:
 - a. Solder-joint Connections: ASME B16.18
- 5. Potable Water Use:
 - a. Certified: Approved for use in compliance with NSF 61 and NSF 372.
 - b. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.
 - c. Bronze Valves:

2.3 BRONZE, ANGLE VALVES

- A. Class 125: CWP Rating: 200 psig: (1380 kPa).
 - 1. Comply with MSS SP-80, Type 1.
 - 2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
 - 3. Ends: Threaded.
 - 4. Stem: Bronze.
 - 5. Disc: Bronze.
 - 6. Packing: Asbestos free.
 - 7. Handwheel: Bronze or aluminum.

2.4 BRASS, BALL VALVES

- A. One-Piece, Reduced-Port with Brass Trim.
 - 1. Comply with MSS SP-110.
 - 2. Body: Forged brass.
 - 3. Ends: Threaded.
 - 4. Seats: PTFE.
 - 5. Stem: Brass.
 - 6. Ball: Chrome-plated brass.
- 1. Two Piece, Full Port and Regular Port with Brass Trim:

- a. Comply with MSS SP-110.
- b. SWP Rating: 150 psig (1035 kPa).
- c. CWP Rating: 600 psig (4140 kPa), WOG.
- d. Body: Forged brass.
- e. Ends: Threaded or soldered.
- f. Seats: PTFE
- g. Stem: Brass.
- h. Ball: stainless steel or aluminum bronze.

2. Two Piece, Full Port with Press Connection:

- a. CWP Rating: 300 psig (___kPa), WOG.
- b. Body: Forged brass.
- c. Seats: PTFE.
- d. Ball: Corrosion-resistant brass.
- e. Stem: Forged brass.
- f. Maximum Service Temperature: 250 deg F (121.1 deg C).

2.5 BRONZE, SWING CHECK VALVES

A. General:

- a. Fabricate from dezincification resistant material.
- b. Copper alloys containing more than 15 percent zinc are not permitted.

B. Class 125: CWP Rating: 200 psig (1380 kPa).

- c. Comply with MSS SP-80, Type 3.
- d. Design: Y-pattern, horizontal or vertical flow.
- e. Body: Bronze, ASTM B62.
- f. Ends: Threaded.
- g. Disc: Bronze.

2.6 IRON, GROOVED-END SWING CHECK VALVES

1. 300 CWP:

- a. CWP Rating: 300 psig (2070 kPa).
- b. Body: ASTM A536, Grade 65-45-12 ductile iron.
- c. Seal: EPDM.
- d. Disc: Ductile iron.
- e. Coating: Black, non-lead paint
- f.

2.7 IRON, PLATE TYPE CHECK VALVES

1. Class 125 Single-Plate

- a. Comply with API STD 594.
- b. CWP Rating: 200 psig (1380 kPa).
- c. Design: Wafer, stainless steel spring-loaded plate.
- d. Body: ASTM A126, gray iron.

- e. Resilient Seat: EPDM.

2.8 BRONZE, GATE VALVES

- 1. General
 - a. Fabricate from dezincification resistant material.
 - b. Copper alloys containing more than 15 percent zinc are not permitted.
- 2. Rising Stem (RS):
 - a. Comply with MSS SP-80, Type I.
 - b. Class 125: CWP Rating: 200 psig: (1380 kPa).
 - c. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.

2.9 BRONZE, GLOBE VALVES

- 1. General
 - a. Fabricate from dezincification resistant material.
 - b. Copper alloys containing more than 15 percent zinc are not permitted.
- 2. Class 125: CWP Rating: 200 psig: (1380 kPa).
 - a. Comply with MSS SP-80, Type I.
 - b. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
 - c. Ends: Threaded joint.
 - d. Stem: Bronze.
 - e. Disc: PTFE or TFE.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable Iron.

PART 3: EXECUTION

3.1 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

3.2 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Install check valves where necessary to maintain direction of flow as follows:
 - 1. Lift Check: Install with stem plumb and vertical.
 - 2. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION 22 05 23

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1: GENERAL

1.1 SECTION INCLUDES

- A. Support and attachment components for equipment, piping, and other plumbing work.

1.2 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping; 2014.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2018).
- F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- H. MFMA-4 - Metal Framing Standards Publication; 2004.
- I. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.
- J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

4. Coordinate the arrangement of supports with ductwork, piping, equipment, and other potential conflicts installed under other sections or by others.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- A. Sequencing:
 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured.

1.4 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.5 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2: PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Metal Channel (Strut) Framing Systems:

1. Manufacturers:
 - a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Comply with MFMA-4.
3. Channel Material:
 - a. Indoor Dry Locations: Use zinc-plated steel or galvanized steel.
4. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
5. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Piping up to 1 inch (27 mm) nominal: 1/4-inch (6 mm) diameter.
 - b. Piping larger than 1 inch (27 mm) nominal: 3/8-inch (10 mm) diameter.
 - c. Trapeze Support for Multiple Pipes: 3/8-inch (10 mm) diameter.

C. Thermal Insulated Pipe Supports:

1. General Construction and Requirements:
 - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

- b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
 - c. Pipe supports to be provided for nominally sized, 1/2 inch to 30-inch (12.7 mm to 762 mm) iron pipes.
2. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
- a. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
 - b. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
2. Riser Clamps:
- a. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
3. Pipe Hangers: For a given pipe run, use hangers of the same type and material.
- a. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
 - b. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
4. Pipe Shields for Insulated Piping:
- a. General Construction and Requirements:
 - 1. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
 - 2. Shields Material: UV-resistant polypropylene with glass fill.
 - 3. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch (321 mm).
 - 4. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
 - 5. Maximum Service Temperature: 178 degrees F (81 degrees C).
 - 6. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
5. Anchors and Fasteners:
- a. Manufacturers - Mechanical Anchors:
 - i. Hilti, Inc: www.us.hilti.com/#sle.
 - ii. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
 - iii. Powers Fasteners, Inc: www.powers.com/#sle.
 - iv. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
 - b. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
 - c. Concrete: Use expansion anchors or screw anchors.

- d. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
- e. Hollow Masonry: Use toggle bolts.
- f. Hollow Stud Walls: Use toggle bolts.
- g. Steel: Use beam clamps, machine bolts, or welded threaded studs.
- h. Sheet Metal: Use sheet metal screws.
- i. Plastic and lead anchors are not permitted.
- j. Powder-actuated fasteners are not permitted.
- k. Hammer-driven anchors and fasteners are not permitted.
- l. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3: EXECUTION

A. EXAMINATION

- 1. Verify that field measurements are as indicated.
- 2. Verify that mounting surfaces are ready to receive support and attachment components.
- 3. Verify that conditions are satisfactory for installation prior to starting work.

B. INSTALLATION

- 1. Install products in accordance with manufacturer's instructions.
- 2. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- 3. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- 4. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- 5. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- 6. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- 7. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

8. Equipment Support and Attachment:
 - a. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - b. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - c. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - d. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
9. Secure fasteners according to manufacturer's recommended torque settings.
10. Remove temporary supports.

C. FIELD QUALITY CONTROL

1. Inspect support and attachment components for damage and defects.
2. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
3. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 22 05 29

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1: GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Ceiling tacks.

1.2 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

1.3 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.

PART 2: PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

- A. Automatic Controls: Tags. Key to control schematic.
- B. Control Panels: Nameplates.
- C. Heat Transfer Equipment: Nameplates.
- D. Instrumentation: Tags.
- E. Major Control Components: Nameplates.
- F. Piping: Tags.
- G. Small-sized Equipment: Tags.
- H. Valves: Tags and ceiling tacks where located above lay-in ceiling.
- I. Water Treatment Devices: Nameplates.

2.2 NAMEPLATES

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 3. Seton Identification Products: www.seton.com/#sle.
- B. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: ¼ inch (6 mm).
3. Background Color: Black.
4. Plastic: Comply with ASTM D709.

2.3 TAGS

- A. Manufacturers:
1. Advanced Graphic Engraving:
www.advancedgraphicengraving.com/#sle
 2. Brady Corporation: www.bradycorp.com/#sle.
 3. Brimar Industries, Inc: www.pipemarker.com/#sle.
 4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 5. Seton Identification Products: www.seton.com/#sle.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.
- C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

2.4 STENCILS

- A. Manufacturers:
1. Brady Corporation: www.bradycorp.com
 2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 3. Seton Identification Products: www.seton.com/#sle.
- B. Stencils: With clean cut symbols and letters of following size:
1. 3/4 to 1-1/4 inch (20-30 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 1/2 inch (15 mm) high letters.
 2. 1-1/2 to 2 inch (40-50 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 3/4 inch (20 mm) high letters.
 3. 2-1/2 to 6 inch (65-150 mm) Outside Diameter of Insulation or Pipe: 12 inch (300 mm) long color field, 1-1/4 inch (30 mm) high letters.
- C. Stencil Paint: As specified in Section 09 9123, semi-gloss enamel, colors complying with ASME A13.1.

2.5 PIPE MARKERS

- A. Manufacturers:
1. Brady Corporation: www.bradycorp.com/#sle.
 2. Brimar Industries, Inc: www.pipemarker.com/#sle.
 3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 4. Seton Identification Products: www.seton.com/#sle.
- B. Comply with ASME A13.1.
1. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

2. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
3. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.
4. Color code as follows:
 - a. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.
 - b. Fire Quenching Fluids: Red with white letters.

2.6 CEILING TACKS

1. Description: Steel with 3/4-inch (20 mm) diameter color coded head.
2. Color code as follows:
 - a. HVAC Equipment: Yellow.
 - b. Fire Dampers and Smoke Dampers: Red.
 - c. Plumbing Valves: Green.
 - d. Heating/Cooling Valves: Blue.

PART 3: EXECUTION

3.1 PREPARATION

1. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

1. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
2. Install tags with corrosion resistant chain.
3. Install plastic pipe markers in accordance with manufacturer's instructions.
4. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
5. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.
6. Use tags on piping 3/4 inch (20 mm) diameter and smaller.
 - a. Identify service, flow direction, and pressure.
 - b. Install in clear view and align with axis of piping.
 - c. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

7. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
8. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 22 05 53

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1: GENERAL

1.1 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.2 RELATED REQUIREMENTS

- A. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.3 REFERENCE STANDARDS

- A. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).
- B. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013).
- C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2020.
- D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2019.
- E. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2010 (Reapproved 2016).
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2: PRODUCTS

2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER

- A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
 - 2. Maximum Service Temperature: 850 degrees F (454 degrees C).
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- B. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/Pa s m).
- C. Tie Wire: 0.048-inch (1.22 mm) stainless steel with twisted ends on maximum 12-inch (300 mm) centers.
- D. Vapor Barrier Lap Adhesive: Compatible with insulation.
- E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
 - 1. Fibrous Glass Fabric:
 - 2. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
 - 3. Blanket: 1.0 lb/cu ft (16 kg/cu m) density.
 - 4. Weave: 5 by 5.
- F. Indoor Vapor Barrier Finish:
 - 1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
 - 2. Vinyl emulsion type acrylic, compatible with insulation, black color.
- G. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- H. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- I. Insulating Cement: ASTM C449.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
 - 1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
 - 2. Maximum Service Temperature: 220 degrees F (104 degrees C).
 - 3. Connection: Waterproof vapor barrier adhesive.
- B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 JACKETS

- A. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
- B. Thickness: 0.016-inch (0.40 mm) sheet.
- C. Finish: Smooth.
- D. Joining: Longitudinal slip joints and 2-inch (50 mm) laps.
- E. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
- F. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

PART 3: EXECUTION

3.1 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- D. Glass fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

- E. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- F. Glass fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers
- G. Inserts and Shields:
 - 1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert Location: Between support shield and piping and under the finish jacket.
 - 4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.
- I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with canvas jacket sized for finish painting.

END OF SECTION 22 07 19

SECTION 22 10 05
PLUMBING PIPING

PART 1: GENERAL

1.1 SECTION INCLUDES

- A. Pipe, pipe fittings, specialties, and connections for piping systems.
 - 1. Sanitary sewer.
 - 2. Domestic water.
 - 3. Flanges, unions, and couplings.
 - 4. Pipe hangers and supports.
 - 5. Ball valves.
 - 6. Butterfly valves.
 - 7. Balancing valves.
 - 8. Check.

1.2 RELATED REQUIREMENTS

- A. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- B. Section 22 0553 - Identification for Plumbing Piping and Equipment.
- C. Section 22 0719 - Plumbing Piping Insulation.
- D. Section 33 0110.58 - Disinfection of Water Utility Piping Systems.

1.3 REFERENCE STANDARDS

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.
- D. ASME B31.1 - Power Piping; 2020.
- E. ASME B31.9 - Building Services Piping; 2017.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.
- G. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2020.
- H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.
- I. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- J. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2020.
- K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

- L. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.
- M. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.
- N. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.
- O. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.
- P. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.
- Q. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2016.
- R. AWWA C651 - Disinfecting Water Mains; 2014.
- S. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2017 (Revised 2018).
- T. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2012 (Revised 2018).
- U. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.
- V. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2015.
- W. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015.
- X. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018
- Y. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
- Z. NSF 61 - Drinking Water System Components - Health Effects; 2020.
- AA. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.4 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

- C. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.
- D. Project Record Documents: Record actual locations of valves.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Product Requirements, for additional provisions.
 - 2. Valve Repacking Kits: One for each type and size of valve.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2: PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

- A. PVC Pipe: ASTM D2665 or ASTM D3034.
- B. Fittings: PVC.
- C. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.3 SANITARY SEWER PIPING, ABOVE GRADE

- A. PVC Pipe: ASTM D2665 or ASTM D3034
- B. Fittings: PVC.

Joints: Solvent welded, with ASTM D2564 solvent cement

2.4 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).
- B. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
- C. Joints: ASTM B32, alloy Sn95 solder.

2.5 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
- B. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
- C. Joints: Threaded or welded to ASME B31.1.

2.6 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
 - 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
- B. Flanges for Pipe Size Over 1 Inch (25 mm):
 - 1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.7 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
- B. Plumbing Piping - Drain, Waste, and Vent:
 - 1. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Malleable iron, adjustable swivel, split ring.
 - 2. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
- C. Plumbing Piping – Water:
 - 1. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Malleable iron, adjustable swivel, split ring.
 - 2. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
 - 3. Hangers for Hot Pipe Sizes 2 Inches (50 mm) to 4 Inches (100 mm): Carbon steel, adjustable, clevis.

Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.

Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.

Concrete Screw Type Anchors: Complying with ICC-ES AC193.

Masonry Screw Type Anchors: Complying with ICC-ES AC106.

2.8 BALL VALVES

A. Manufacturers:

1. Apollo Valves: www.apollovalves.com/#sle.
2. Grinnell Products, a Tyco Business: www.grinnell.com/#sle.
3. Nibco, Inc: www.nibco.com/#sle.
 - aa. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union

PART 3: EXECUTION

3.1 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
E. Group piping whenever practical at common elevations.
F. Provide clearance in hangers and from structure and other equipment for Installation of insulation and access to valves and fittings.
 1. See Section 22 0719.
G. Provide access where valves and fittings are not exposed.
H. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.
I. Install valves with stems upright or horizontal, not inverted. See Section 22 0523.
J. Install water piping to ASME B31.9.
K. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
L. Sleeve pipes passing through partitions, walls, and floors
M. Pipe Hangers and Supports:

1. Support horizontal piping as indicated.
2. Install hangers to provide minimum 1/2-inch (15 mm) space between finished covering and adjacent work.
3. Place hangers within 12 inches (300 mm) of each horizontal elbow.
 4. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 7. Provide copper plated hangers and supports for copper piping.
 - a. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 - b. Provide hangers adjacent to motor-driven equipment with vibration isolation; see Section 22 0548.
 8. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.4 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.5 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2-inch (10 mm) vertically of location indicated and slope to drain at minimum of 1/4 inch per foot (1:50) slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect water distribution system in accordance with Section 33 0110.58.
- B. Prior to starting work, verify system is complete, flushed, and clean.
- C. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- D. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- F. Maintain disinfectant in system for 24 hours.
- G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

- H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION 22 10 05

SECTION 22 10 06
PLUMBING PIPING SPECIALTIES

PART 1: GENERAL

1.1 SECTION INCLUDES

- A. Drains.
- B. Cleanouts.
- C. Refrigerator valve and recessed box.
- D. Backflow preventers.
- E. Water hammer arrestors.
- F. Mixing Valves

1.2 RELATED REQUIREMENTS

- A. Section 22 1005 - Plumbing Piping.

1.3 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASME A112.6.3 - Floor and Trench Drains; 2019.
- C. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2017.
- D. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent; 2009.
- E. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.
- F. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011 (Reaffirmed 2016).
- G. NSF 61 - Drinking Water System Components - Health Effects; 2020.
- H. NSF 372 - Drinking Water System Components - Lead Content; 2016.
- I. PDI-WH 201 - Water Hammer Arresters; 2017.

1.4 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

- D. Operation Data: Indicate frequency of treatment required for interceptors.
- E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Product Requirements, for additional provisions
 - 2. Extra Loose Keys for Outside Hose Bibbs: One.
 - 3. Extra Hose End Vacuum Breakers for Hose Bibbs: One

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2: PRODUCTS

2.1 GENERAL REQUIREMENTS

- a. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.2 DRAINS

- A. Manufacturers:
 - a. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
 - b. Josam Company: www.josam.com/#sle.
 - c. Zurn Industries, LLC: www.zurn.com/#sle.

2.3 CLEANOUTS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle
 - 2. Josam Company: www.josam.com/#sle
 - 3. Zurn Industries, LLC: www.zurn.com/#sle

2.4 WATER HAMMER ARRESTORS

- A. Manufacturers:
 - 1.. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle
 - 2. Josam Company: www.josam.com/#sle
 - 3. Zurn Industries, LLC: www.zurn.com/#sle

- B. Water Hammer Arrestors:

- 1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F (minus 73 to 149 degrees C) and maximum 250 psi (1700 kPa) working pressure.

2.5 MIXING VALVES

A. Thermostatic Mixing Valves:

1.. Manufacturers:

- a. Leonard Valve Company: www.leonardvalve.com/#sle.
- b. Symmons: www.symmons.com/#sle.
- c. Watts: <https://www.watts.com/#sle>.

- B. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.

PART 3: EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

1. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
2. Install floor cleanouts at elevation to accommodate finished floor.
3. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur, on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, Interior and exterior hose bibbs.
4. Install air chambers on hot and cold-water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch (20 mm) minimum, and minimum 18 inches (450 mm) long.

END OF SECTION 22 10 06

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Adhesive-backed duct markers.
- D. Stencils.
- E. Ceiling tacks

1.03 REFERENCE STANDARDS

- A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Air Terminal Units: Tags.
- C. Dampers: Ceiling tacks, where located above lay-in ceiling.
- D. Small-sized Equipment: Tags.
- E. Thermostats: Nameplates.

2.02 NAMEPLATES

- A. Letter Color: White.
- B. Letter Height: 1/4 inch (6 mm).
- C. Background Color: Black.
- D. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 CEILING TACKS

- A. Description: Steel with 3/4-inch (20 mm) diameter color coded head.
- B. Color code as follows:
 - 1. HVAC Equipment: Yellow.
 - 2. Fire Dampers and Smoke Dampers: Red.
 - 3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 23 05 53

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.
- C. Vibration measurement of equipment operating conditions.
- D. Commissioning activities.

1.02 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.
- C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems; 2015, Eighth Edition.
- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.03 SUBMITTALS

- A. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Submit to the Construction Manager.
 - 2. Submit two prior to starting the testing, adjusting, and balancing work.
 - 3. Include at least the following in the plan:
 - a. List of all air flow, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - d. Final test report forms to be used.
 - e. Detailed step-by-step procedures for TAB work for each system and issue, including:
 - 1) Terminal flow calibration (for each terminal type).
 - 2) Diffuser proportioning.
 - 3) Branch/submain proportioning.
 - 4) Total flow calculations.
 - 5) Rechecking.
 - 6) Diversity issues.
 - f. Details of how TOTAL flow will be determined, for example:
 - 1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
 - g. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
 - h. Time schedule for TAB work to be done in phases (by floor, etc.).
 - i. Description of TAB work for areas to be built out later, if any.
 - j. Procedures for formal deficiency reports, including scope, frequency, and distribution.

- C. Field Logs: Submit to the Construction Manager.
- E. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. Revise TAB plan to reflect actual procedures and submit as part of final report.
 - 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 - 3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 - 5. Units of Measure: Report data in I-P (inch-pound) units only.
 - 6. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Telephone number of Testing, Adjusting, and Balancing Agency.
 - c. Project name.
 - d. Project location.
 - e. Project Architect.
 - f. Project Engineer.
 - g. Project Contractor.
 - h. Report date.
- F. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 3 EXECUTION

2.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
 - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
 - 3. SMACNA (TAB).
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Having minimum of three years documented experience.
 - 3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
 - b. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.
- D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

2.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.

4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 5. Duct systems are clean of debris.
 6. Fans are rotating correctly.
 7. Fire and volume dampers are in place and open.
 8. Air coil fins are cleaned and combed.
 9. Access doors are closed, and duct end caps are in place.
 10. Air outlets are installed and connected.
 11. Duct system leakage is minimized.
 12. Proper strainer baskets are clean and in place.
 13. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

2.03 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

2.04 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
1. Running log of events and issues.
 2. Discrepancies, deficient or uncompleted work by others.
 3. Contract interpretation requests.
 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
- E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

2.05 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross-sectional area of duct.
- C. Measure air quantities at air inlets and outlets.

- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.

2.06 SCOPE

- A. Test, adjust, and balance the following:
 - 1. Air Cooled Refrigerant Condensers.
 - 2. Packaged Roof Top Heating/Cooling Units.
 - 3. Packaged Terminal Air Conditioning Units.
 - 4. Unit Air Conditioners.
 - 5. Air Handling Units.
 - 6. Fans.
 - 7. Air Filters.
 - 8. Air Inlets and Outlets.

2.07 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
 - 1. Manufacturer.
 - 2. Model/Frame.
 - 3. HP/BHP.
 - 4. Phase, voltage, amperage; nameplate, actual, no load.
 - 5. RPM.
 - 6. Service factor.
 - 7. Starter size, rating, heater elements.
- B. Direct Drives:
 - 1. Identification/location.
 - 2. Required driven RPM, design and actual.
- C. Air Cooled Condensers:

1. Identification/number.
2. Location.
3. Manufacturer.
4. Model number.
5. Serial number.
6. Entering DB air temperature, design and actual.
7. Leaving DB air temperature, design and actual.
8. Number of compressors.

D. Cooling Coils:

1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Entering air DB temperature, design and actual.
7. Entering air WB temperature, design and actual.
8. Leaving air DB temperature, design and actual.
9. Leaving air WB temperature, design and actual.
10. Saturated suction temperature, design and actual.
11. Air pressure drop, design and actual.

E. Electric Duct Heaters:

1. Manufacturer.
2. Identification/number.
3. Location.
4. Model number.
5. Design kW.
6. Number of stages.
7. Phase, voltage, amperage.
8. Test voltage (each phase).
9. Test amperage (each phase).
10. Air flow, specified and actual.
11. Temperature rise, specified and actual.

F. Air Moving Equipment:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Fan RPM.

G. Return Air/Outside Air:

1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

H. Exhaust Fans:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Fan RPM.

I. Duct Leak Tests:

1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
 - a. Blower.
 - b. Orifice, tube size.
 - c. Orifice size.
 - d. Calibrated.
7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

K. Air Distribution Tests:

1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.

10. Percent of design air flow.

L. Vibration Tests:

1. Location of points:
 - a. Fan bearing, drive end.
 - b. Fan bearing, opposite end.
 - c. Motor bearing, center (if applicable).
 - d. Motor bearing, drive end.
 - e. Motor bearing, opposite end.
 - f. Casing (bottom or top).
 - g. Casing (side).
 - h. Duct after flexible connection (discharge).
 - i. Duct after flexible connection (suction).
2. Test readings:
 - a. Horizontal, velocity and displacement.
 - b. Vertical, velocity and displacement.
 - c. Axial, velocity, and displacement.
3. Normally acceptable readings, velocity, and acceleration.
4. Unusual conditions at time of test.
5. Vibration source (if non-complying).

END OF SECTION 23 05 93

SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.

1.03 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.
- B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.
- C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
- G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- B. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. K (Ksi) value: 0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 1200 degrees F (649 degrees C).
 - 3. Maximum Water Vapor Absorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
 - 3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber-based adhesive.
- E. Tie Wire: Annealed steel, 16-gauge, 0.0508-inch diameter (1.29 mm diameter).

2.03 GLASS FIBER, RIGID

- B. Insulation: ASTM C612; rigid, noncombustible blanket.
 - 1. K (Ksi) Value: 0.24 at 75 degrees F (0.036 at 24 degrees C), when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 450 degrees F (232 degrees C).
 - 3. Maximum Water Vapor Absorption: 5.0 percent.
 - 4. Maximum Density: 8.0 lb/cu ft (128 kg/cu m).
- C. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
 - 3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber-based adhesive.
- E. Indoor Vapor Barrier Finish:
 - 1. Vinyl emulsion type acrylic, compatible with insulation, black color.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Insulated Ducts Conveying Air Below Ambient Temperature:
 - 1. Provide insulation with vapor barrier jackets.
 - 2. Finish with tape and vapor barrier jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - 4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated Ducts Conveying Air Above Ambient Temperature:
 - 1. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with aluminum jacket or PVC jacket.
- E. External Duct Insulation Application:
 - 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 - 2. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
 - 3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 - 4. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- F. Duct and Plenum Liner Application:
 - 1. Adhere insulation with adhesive for 90 percent coverage.
 - 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
 - 3. Seal and smooth joints. Seal and coat transverse joints.
 - 4. Seal liner surface penetrations with adhesive.
 - 5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

END OF SECTION 23 07 13

SECTION 23 0719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Flexible removable and reusable blanket insulation.
- C. Jackets and accessories.

1.03 REFERENCE STANDARDS

- A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.
- B. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).
- C. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.07 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
2. Maximum Service Temperature: 180 degrees F (82 degrees C).
3. Connection: Waterproof vapor barrier adhesive.

2.03 JACKETS

- A. PVC Plastic.
 2. Jacket: One-piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F (minus 18 degrees C).
 - b. Maximum Service Temperature: 150 degrees F (66 degrees C).
 - c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/Pa s m), maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil (0.25 mm).
 - e. Connections: Brush on welding adhesive.
 3. Covering Adhesive Mastic: Compatible with insulation.
- C. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
 1. Thickness: 0.016-inch (0.40 mm) sheet.
 2. Finish: Smooth.
 3. Joining: Longitudinal slip joints and 2-inch (50 mm) laps.
 4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
 5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.
- F. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

END OF SECTION 23 07 19

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping.
- B. Refrigerant.
- C. Moisture and liquid indicators.
- D. Valves.
- E. Strainers.
- F. Check valves.
- G. Pressure regulators.
- H. Pressure relief valves.
- I. Filter-driers.

1.02 RELATED REQUIREMENTS

- A. Section 23 07 19 - HVAC Piping Insulation.
- B. Section 23 63 13 - Air Cooled Refrigerant Condensers.

1.03 REFERENCE STANDARDS

- A. AHRI 730 - Flow Capacity Rating and Application of Suction-Line Filters and Suction-Line Filter-Driers; 2005.
- B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
- D. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2013.
- E. ASME B31.9 - Building Services Piping; 2014.
- F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- G. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2013.
- H. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.
- I. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

1.04 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

- C. Valves:
 - 1. Use service valves on suction and discharge of compressors.
- D. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.
- E. Strainers:
 - 1. Use line size strainer upstream of each automatic valve.
- F. Filter-Driers:
 - 1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

1.05 SUBMITTALS

- B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.
- C. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.
- D. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.
- E. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store piping and specialties in shipping containers with labeling in place.
- B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
- C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Comply with ASME B31.9 for installation of piping system.
- B. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

2.02 PIPING

- A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
 - 1. Fittings: ASME B16.22 wrought copper.
 - 2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
- B. Pipe Supports and Anchors:
 - 1. Provide hangers and supports that comply with MSS SP-58.

- a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
4. Wall Support for Pipe Sizes to 3 Inches (75 mm): Cast iron hook.
5. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
6. Vertical Support: Steel riser clamp.
7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
8. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
9. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
10. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
11. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
 - a. Bases: High density, UV tolerant, polypropylene or reinforced PVC.
 - b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 - c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
 - d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
 - e. Height: Provide minimum clearance of 6 inches (150 mm) under pipe to top of roofing.

2.03 REFRIGERANT

2.04 MOISTURE AND LIQUID INDICATORS

- B. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F (93 degrees C) and maximum working pressure of 500 psi (3450 kPa).

2.05 VALVES

- B. Diaphragm Packless Valves:
 1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi (3450 kPa) and maximum temperature of 275 degrees F (135 degrees C).
- C. Packed Angle Valves:
 1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi (3450 kPa) and maximum temperature of 275 degrees F (135 degrees C).
- D. Ball Valves:

1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi (3450 kPa) and maximum temperature of 300 degrees F (149 degrees C).
- E. Service Valves:
1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi (3450 kPa).

2.06 STRAINERS

- B. Straight Line or Angle Line Type:
1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi (2960 kPa).

2.07 CHECK VALVES

- B. Straight Through Type:
1. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi (3450 kPa) and maximum temperature of 200 degrees F (93 degrees C).

2.08 PRESSURE REGULATORS

- B. Brass body, stainless steel diaphragm, direct acting, adjustable over 0 to 80 psi (0 to 550 kPa) range, for maximum working pressure of 450 psi (3100 kPa).

2.09 PRESSURE RELIEF VALVES

- B. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB, selected to ASHRAE Std 15, with standard setting of 235 psi (1620 kPa).

2.10 FILTER-DRIERS

- B. Performance:
1. Pressure Drop: 2 psi (14 kPa), maximum, when operating at full connected evaporator capacity.
 2. Design Working Pressure: 350 psi (2410 kPa), minimum.
- C. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.
- D. Construction: UL listed.
1. Connections: As specified for applicable pipe type.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- E. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.5.
 - 2. Support horizontal piping as indicated.
 - 3. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
- F. Provide clearance for installation of insulation and access to valves and fittings.
- G. Provide access to concealed valves and fittings. Coordinate size and location of access doors.
- H. Insulate piping and equipment; refer to Section and Section 23 0716.
- I. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

3.03 FIELD QUALITY CONTROL

- B. Test refrigeration system in accordance with ASME B31.5.
- C. Pressure test system with dry nitrogen to 200 psi (1380 kPa). Perform final tests at 27 inches (92 kPa) vacuum and 200 psi (1380 kPa) using halide torch. Test to no leakage.

END OF SECTION 23 23 00

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal ductwork.
- B. Nonmetal ductwork.

1.02 REFERENCE STANDARDS

- A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2013.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- F. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2012.
- G. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2013.
- H. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2013.
- I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- J. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.
- K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- L. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012, 2nd Edition.
- M. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.03 SUBMITTALS

- A. Product Data: Provide data for duct materials.
- B. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for 2-inch pressure class and higher systems.
- D. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.05 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

- A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.
- B. Ducts: Galvanized steel, unless otherwise indicated.
- C. Low Pressure Supply (System with Cooling Coils): 2-inch w.g. (500 Pa) pressure class, galvanized steel.
- D. Return and Relief: 1-inch w.g. (250 Pa) pressure class, galvanized steel.
- E. General Exhaust: 1-inch w.g. (250 Pa) pressure class, galvanized steel.
- F. Outside Air Intake: 1-inch w.g. (250 Pa) pressure class, galvanized steel.
- G. Transfer Air and Sound Boots: 1/2-inch wg (125 Pa) pressure class, fibrous glass.

2.02 MATERIALS

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. Un-Galvanized Steel for Ducts: ASTM A1008/A1008M, Designation CS (commercial steel), cold-rolled.
- C. Aluminum for Ducts: ASTM B209 (ASTM B209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.
- D. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
 - 1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
 - 2. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
 - 3. For Use with Flexible Ducts: UL labeled.
- E. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.03 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
- B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

- D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- E. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side, seal to louver frame and duct.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

- A. Spiral Ducts: Round spiral lockseam duct with galvanized steel outer wall.
 - 1. Manufacture in accordance with SMACNA (DCS).
- B. Round Ducts: Round lockseam duct with galvanized steel outer wall.
 - 1. Manufacture in accordance with SMACNA (DCS).
- C. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.
 - 1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
 - 2. Pressure Rating: 10 inches wg (2.50 kPa) positive and 1.0 inches wg (250 Pa) negative.
 - 3. Maximum Velocity: 4000 fpm (20.3 m/sec).
 - 4. Temperature Range: Minus 10 degrees F to 160 degrees F (Minus 23 degrees C to 71 degrees C).

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Flexible Ducts: Connect to metal ducts with adhesive.
- E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- G. Use double nuts and lock washers on threaded rod supports.
- H. At exterior wall louvers, seal duct to louver frame.

3.02 CLEANING

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

END OF SECTION 23 31 00

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Duct access doors.
- D. Duct test holes.
- E. Flexible duct connectors.
- F. Volume control dampers.

1.02 RELATED REQUIREMENTS

- A. Section 23 3100 - HVAC Ducts and Casings.
- B. Section 23 3600 - Air Terminal Units: Pressure regulating damper assemblies.
- C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- B. NFPA 92 - Standard for Smoke Control Systems; 2015.
- C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- D. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.
- E. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
- B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.
- C. Manufacturer's Installation Instructions: Provide instructions for fire dampers.
- D. Project Record Drawings: Record actual locations of access doors and test holes.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Fusible Links: One of each type and size.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

- B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 BACKDRAFT DAMPERS - METAL

- B. Gravity Backdraft Dampers, Size 18 by 18 inches (450 by 450 mm) or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.
- C. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6-inch (150 mm) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 DUCT ACCESS DOORS

- B. Fabricate in accordance with SMACNA (DCS).
- C. Access doors with sheet metal screw fasteners are not acceptable.

2.04 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.05 FLEXIBLE DUCT CONNECTORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd (1.0 kg/sq m).
- C. Maximum Installed Length: 14 inch (356 mm).

2.06 VOLUME CONTROL DAMPERS

- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Splitter Dampers:
 - 1. Material: Same gauge as duct to 24 inches (600 mm) size in either direction, and two gauges heavier for sizes over 24 inches (600 mm).
 - 2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
 - 3. Operator: Minimum 1/4-inch (6 mm) diameter rod in self aligning, universal joint action, flanged bushing with set screw.
- D. Single Blade Dampers:
 - 1. Fabricate for duct sizes up to 6 by 30 inch (150 by 760 mm).
 - 2. Blade: 24-gauge, 0.0239 inch (0.61 mm), minimum.

- E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch (200 by 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
 - 1. Blade: 18-gauge, 0.0478 inch (1.21 mm), minimum.
- F. End Bearings: Except in round ducts 12 inches (300 mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
- G. Quadrants:
 - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 - 3. Where rod lengths exceed 30 inches (750 mm) provide regulator at both ends.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 by 8-inch (200 by 200 mm) size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch (100 by 100 mm) for balancing dampers only. Review locations prior to fabrication.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. Provide fire dampers and combination fire and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings, and hinges.
- F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.
- G. Demonstrate re-setting of fire dampers to Owner's representative.
- H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
- J. Use splitter dampers only where indicated.

END OF SECTION 23 33 00

SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power Ventilators
- B. Cabinet exhaust fans.

1.02 RELATED REQUIREMENTS

- A. Section 23 3300 - Air Duct Accessories: Backdraft dampers.
- B. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; <http://www.amca.org/certified/search/company.aspx>.
- B. AMCA 99 - Standards Handbook; 2010.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Manufacturer's Instructions: Indicate installation instructions.
- D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.07 FIELD CONDITIONS

- A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.01 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.
- B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
- D. Fabrication: Comply with AMCA 99.
- E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.04 CABINET EXHAUST FANS

- A. Performance Ratings: Refer to plans.
- B. Centrifugal Fan Unit: Direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- C. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.
- D. Grille: Aluminum with baked white enamel finish.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.
- C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.
- D. Install backdraft dampers on inlet to roof exhausters.
- E. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION 23 34 23

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Diffusers:
- B. Rectangular ceiling diffusers.
- C. Registers/grilles:
 - 1. Ceiling-mounted, exhaust and return register/grilles.
 - 2. Wall-mounted, supply register/grilles.
 - 3. Wall-mounted, exhaust and return register/grilles.
- D. Louvers:

1.03 REFERENCE STANDARDS

- A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2012.
- B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (R2011).
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- D. UL 2518 - Standard for Safety Air Dispersion Systems; Current Edition, Including All Revisions.
- E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.
- F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- G. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.
- H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.04 SUBMITTALS

- A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- B. Project Record Documents: Record actual locations of air outlets and inlets.

1.05 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

PART 2 PRODUCTS

2.01 RECTANGULAR CEILING DIFFUSERS

- A. Type: Provide square, adjustable pattern stamped, multi-core and multi-louvered diffuser to discharge air in 360-degree, one way, two-way, three way, and four way pattern with sectorizing baffles where indicated.
- B. Connections: Round.

- C. Frame: Provide surface mount, snap-in, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.
- D. Fabrication: Steel with baked enamel finish.
- E. Color: As selected by Architect from manufacturer's standard range.

2.02 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with blades set at 45 degrees, vertical face.
- B. Frame: 1-1/4-inch (32 mm) margin with countersunk screw mounting.
- C. Fabrication: Steel with 20-gauge, 0.0359 inch (0.91 mm) minimum frames and 22-gauge, 0.0299 inch (0.76 mm) minimum blades, steel and aluminum with 20 gauge, 0.0359 inch (0.91 mm) minimum frame, or aluminum extrusions, with factory baked enamel finish.
- D. Color: To be selected by Architect from manufacturer's standard range.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

2.03 WALL SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable blades, 3/4-inch (19 mm) minimum depth, 3/4-inch (19 mm) maximum spacing with spring or other device to set blades, vertical face, double deflection.
- B. Frame: 1-1/4-inch (32 mm) margin with countersunk screw mounting and gasket.
- C. Fabrication: Steel with 20-gauge, 0.0359 inch (0.91 mm) minimum frames and 22-gauge, 0.0299 inch (0.76 mm) minimum blades, steel and aluminum with 20 gauge, 0.0359 inch (0.91 mm) minimum frame, or aluminum extrusions, with factory baked enamel finish.
- D. Color: To be selected by Architect from manufacturer's standard range.
- E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.04 WALL EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with spring or other device to set blades, vertical face.
- B. Frame: 1-1/4-inch (32 mm) margin with countersunk screw mounting.
- C. Fabrication: Steel frames and blades, with factory baked enamel finish.
- D. Color: To be selected by Architect from manufacturer's standard range.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.
- F. Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

2.05 LOUVERS

- A. Type: 6 inch (150 mm) deep frame with blades on 45-degree slope with center baffle and return bend, heavy channel frame, 1/2 inch (13 mm) square mesh screen over intake or exhaust end.
- B. Mounting: Furnish with interior flat flange for installation.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black.

END OF SECTION 23 37 00

SECTION 23 63 13
AIR COOLED REFRIGERANT CONDENSERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured units.
- B. Casing.
- C. Condenser coils.
- D. Fans and motors.

1.02 RELATED REQUIREMENTS

- A. Section 23 2300 - Refrigerant Piping.
- B. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008, Including All Addenda.
- B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.
- C. ASHRAE Std 20 - Methods of Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers; 2019.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- E. NEMA MG 1 - Motors and Generators; 2014.
- F. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide rated capacities, weights, accessories, electrical requirements, and wiring diagrams.
- B. Shop Drawings: Indicate components, assembly, dimensions, weights, and loading, required clearances, and location and size of field connections. Include schematic layouts showing condenser, refrigeration compressors, cooling coils, refrigerant piping, and accessories required for complete system.
- C. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.
- D. Operation and Maintenance Data: Include start-up instructions, maintenance instructions, parts lists, controls, and accessories.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.
- B. Protect units on site from physical damage. Protect coils.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Provide packaged, factory assembled, pre-wired unit, suitable for outdoor use consisting of casing, condensing coil and fans, integral sub-cooling coil liquid accumulator.
- B. Construction and Ratings: In accordance with AHRI 210/240 and UL 207. Testing shall be in accordance with ASHRAE Std 20.

2.02 CASING

- A. House components in welded steel frame with steel panels with weather resistant, baked enamel finish.

2.03 CONDENSER COILS

- A. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 425 psig (2900 kPa), and vacuum dehydrate. Seal with holding charge of nitrogen.

2.04 FANS AND MOTORS

- A. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge, equipped with roller or ball bearings with grease fittings extended to outside of casing.
- B. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or 3 phase, with permanent lubricated ball bearings and built-in current and thermal overload protection; refer to Section 23 0513.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide for connection to electrical service. Refer to Section 26 0583.
- C. Provide connection to refrigeration piping system. Refer to Section 23 2300. Comply with ASHRAE Std 15.
- D. Provide cooling season start-up, winter season shut-down service, for first year of operation.
- E. Shut-down system if initial start-up and testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

END OF SECTION 23 63 13

SECTION 23 81 26.13
SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air-source heat pumps.
- B. Air cooled condensing units.
- C. Indoor air handling (fan and coil) units for ducted systems.
- D. Indoor air handling (fan and coil) units for ductless systems.
- E. Controls.

1.02 RELATED REQUIREMENTS

- A. Section 23 3100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

- A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008, Including All Addenda.
- B. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment; 2015.
- C. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.
- D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.
- E. ASHRAE Std 23.1 - Methods of Testing for Rating the Performance of Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant; 2010.
- F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- G. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.
- H. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- C. Design Data: Indicate refrigerant pipe sizing.
- D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- G. Project Record Documents: Record actual locations of components and connections.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Filters: One for each unit.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 SYSTEM DESIGN

- A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
 1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator; auxiliary electric heat.
 2. Cooling: Outdoor electric condensing unit with evaporator coils in multiple ductless indoor units ("mini-split").
 3. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.
- B. Performance Requirements: See Drawings for additional requirements.

2.02 INDOOR AIR HANDLING UNITS FOR DUCTED SYSTEMS

- A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
 1. Air Flow Configuration: Convertible vertical or horizontal configuration.
 2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
- B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor, or thermostatic expansion valve.
 1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
 2. Manufacturers: System manufacturer.

2.03 INDOOR AIR HANDLING UNITS FOR DUCTLESS SYSTEMS

- A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
 1. Filter return air with washable, antioxidant pre-filter and a pleated anti-allergy enzyme filter.
- B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor, or thermostatic expansion valve.
 1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
 2. Manufacturer: System manufacturer.

2.04 OUTDOOR UNITS

- A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
 - 1. Refrigerant: R-410A.
 - 2. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
 - 3. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.
- B. Compressor: Scroll or inverter driven, max 3600 rpm, AHRI 520 resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.
- C. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
- D. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
 - 1. Provide thermostatic expansion valves, as applicable.
 - 2. Provide heat pump reversing valves, as applicable.
- E. Mounting Pad: reinforced concrete equipment pad, minimum 4 inches (100 mm) thick.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available and in correct location.
- C. Verify that proper fuel supply is available for connection.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.
- B. Install in accordance with NFPA 90A and NFPA 90B.
- C. Install refrigeration systems in accordance with ASHRAE Std 15.

END OF SECTION 23 81 26.13

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Nonmetallic underground conduit with conductors, Type NUCC.
3. Connectors

1.2 ACTION SUBMITTALS

A. Product Data:

1. Copper building wire.
2. Nonmetallic underground conduit with conductors, Type NUCC.
3. Metal-clad cable, Type MC.
4. Connectors

B. Product Schedule: Indicate type, use, location, and termination locations.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

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. Belden Inc.
2. Cerro Wire LLC
3. Encore Wire Corporation
4. General Cable; Prysmian Group North America
5. Okonite Company (The)
6. Service Wire Co.
7. Southwire Company, LLC
8. WESCO

B. Description: Flexible, insulated, and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 ASTM B496 for stranded conductors.
- E. Conductor Insulation:
 - 1. Type NM. Comply with UL 83 and UL 719.
 - 2. Type THHN, and, Type THWN-2. Comply with UL 83.
 - 3. Type THW and Type THW-2. Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
- F. Shield:
 - 1. Type TC-ER: Cable designed for use with ASDs, with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire dual spirally wrapped copper tape shields and three bare symmetrically applied ground wires, and sunlight- and oil-resistant outer PVC jacket.

2.2 NONMETALLIC UNDERGROUND CONDUIT WITH CONDUCTORS, TYPE NUCC

- A. Description: A factory assembly of conductors or cables inside a nonmetallic, smooth wall raceway with a circular cross section.
- B. Applicable Standards:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics:
 - a. Reference Standards: UL 1990.

2.3 CONNECTORS AND SPLICES

- 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. 3M Electrical Products
 - 2. ABB, Electrification Business
 - 3. AFC Cable Systems; Atkore International
 - 4. Gardner Bender
 - 5. Hubbell Utility Solutions; Hubbell Incorporated
 - 6. Ideal Industries, Inc.
 - 7. ILSCO
 - 8. NSi Industries LLC
 - 9. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
 - 10. Service Wire Co.
 - 11. TE Connectivity Ltd.
- B. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and

use.

- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 - 1. Material: Copper.
 - 2. Type: Two hole with barrels.
 - 3. Termination: Compression Crimp.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders:
 - 1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
 - 2. Copper for feeders smaller than No. 4 AWG; copper for feeders No. 4 AWG and larger. Conductors must be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits:
 - 1. Copper:
 - a. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. ASD Output Circuits Cable: Extra-flexible stranded for all sizes.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway, Armored cable, Type AC.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway, Type XHHW-2, single conductors in raceway, Underground feeder cable, Type UF.
- E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway, Armored cable, Type AC.
- F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway, Type XHHW-2, single conductors in raceway, Underground branch-circuit cable, Type UF.

3.3 INSTALLATION, GENERAL

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points in accordance with Section 26 05 33.13 "Conduits for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- F. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6-inches, 12 inches of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

END OF SECTION 26 05 19

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grounding and bonding conductors.
2. Intersystem bonding bridge grounding connector.
3. Grounding and bonding busbars.
4. Grounding (earthing) electrodes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Product Data:

1. Third-Party Certifications: For each product.
2. Third-Party Certified Life Cycle Assessment: For each product.

C. Shop Drawings: Plans showing dimensioned locations of grounding features described in "Field Quality Control for Grounding and Bonding of Electrical Power" Article, including the following:

1. Grounding electrode access enclosures.
2. Grounding electrodes.
3. Grounding arrangements and connections for separately derived systems.

D. Field quality-control reports.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. In addition to items specified in Section 260010 "Supplemental Requirements for Electrical," include the following:
 - a. Plans showing locations of grounding features described in "Field Quality Control for Grounding and Bonding of Electrical Power" Article, including the following:
 - 1) Grounding electrode access enclosures.
 - 2) Grounding electrodes.
 - 3) Grounding arrangements and connections for separately derived systems.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment Grounding Conductor:

1. General Characteristics: 600 V, THHN/THWN-2 or THWN-2, copper or tinned-copper wire or cable, green color, in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Isolated Equipment Grounding Conductor:

1. General Characteristics: 600 V, THHN/THWN-2 or THWN-2, copper or tinned-copper wire or cable, green color with one or more yellow stripes, in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. ASTM - Bare Copper Grounding and Bonding Conductor:

1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ERICO; brand of nVent Electrical plc
 - b. Harger Lightning & Grounding; business of Harger, Inc.
 - c. <Insert manufacturer's name>
2. Referenced Standards: Complying with one or more of the following:
 - a. Soft or Annealed Copper Wire: ASTM B3.
 - b. Concentric-Lay Stranded Copper Conductor: ASTM B8.
 - c. Tin-Coated Soft or Annealed Copper Wire: ASTM B33.
 - d. 19-Wire Combination Unilay-Stranded Copper Conductor: ASTM B787/B787M.

2.2 GROUNDING AND BONDING CLAMPS

A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2. Listing Criteria:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

2.3 GROUNDING AND BONDING BUSHINGS

- A. Description: Bonding bushings connect conduit fittings, tubing fittings, threaded metal conduit, and unthreaded metal conduit to metal boxes and equipment enclosures and have one or more bonding screws intended to provide electrical continuity between bushing and enclosure. Grounding bushings have provision for connection of bonding or grounding conductor and may or may not also have bonding screws.
- B. Source Limitations: Obtain products from single manufacturer.
- C. Performance Criteria:
 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
 2. Listing Criteria:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

2.4 GROUNDING AND BONDING HUBS

- A. Description: Hubs with certified grounding or bonding locknut.
- B. Source Limitations: Obtain products from single manufacturer.
- C. Performance Criteria:
 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
 2. Listing Criteria:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

2.5 GROUNDING AND BONDING CONNECTORS

- A. Source Limitations: Obtain products from single manufacturer.
- B. Performance Criteria:

1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

2.6 INTERSYSTEM BONDING BRIDGE GROUNDING CONNECTORS

- A. Description: Devices that provide means for connecting communications systems grounding and bonding conductors at service equipment or at disconnecting means for buildings or structures.
- B. Performance Criteria:
 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
 2. Listing Criteria:
 - a. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

2.7 GROUNDING AND BONDING BUSBARS

- A. Description: Miscellaneous grounding and bonding devices that serve as common connection for multiple grounding and bonding conductors.
- B. Source Limitations: Obtain products from single manufacturer.
- C. Performance Criteria:
 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
 2. Listing Criteria:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

2.8 SIGNAL REFERENCE GRIDS

- A. Description: Means for providing low-impedance path to ground over a large area, approximating an equipotential plan, while simultaneously mitigating large current spikes from faults or lightning.
- B. Source Limitations: Obtain products from single manufacturer.
- C. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
 - 2. Listing Criteria:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

2.9 GROUNDING (EARTHING) ELECTRODES

- A. Source Limitations: Obtain products from single manufacturer.
- B. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
 - 2. Listing Criteria:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

2.10 GROUNDING ELECTRODE ENCLOSURES

- A. Description: Enclosures designed to protect grounding electrodes from damage while providing access for inspection and testing of the grounding system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.
- B. Inspect test results of grounding system measured at point of electrical service

equipment connection.

- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of electrical service equipment only after unsatisfactory conditions have been corrected.

3.2 SELECTION OF GROUNDING AND BONDING PRODUCTS

A. Grounding and Bonding Conductors:

- 1. Provide solid conductor for 8 AWG and smaller, and stranded conductors for 6 AWG and larger unless otherwise indicated.
- 2. Custom-Length Insulated Equipment Bonding Jumpers: 6 AWG, 19-strand, Type THHN.
- 3. Bonding Cable: 28 kcmil, 14 strands of 17 AWG conductor, 1/4 inch in diameter.
- 4. Bonding Conductor: 4 AWG or 6 AWG, stranded conductor.
- 5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.
- 6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.
- 7. Underground Grounding Conductors: Install bare tinned-copper conductor, 2/0 AWG minimum.

B. Grounding and Bonding Connectors:

- 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
- 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
- 3. Connections to Ground Rods at Test Wells: Bolted connectors.
- 4. Connections to Structural Steel: Welded connectors.

C. Grounding and Bonding Busbars: Provide in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated on Drawings.

D. Substation Signal Reference Grid:

- 1. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with IEEE C2.
 - a. Install 8 AWG 6 AWG bonding conductors below grade in a grid pattern on 2 ft centers. Bond grid conductors with exothermic welds where they cross each other.
 - b. Grid must fill entire area inside equipment yard fence, and extend minimum 6.5 ft outside fence, so someone walking or running outside yard may not touch fence or open gate without first stepping inside grid.
 - c. Bond each metal fence post and gate post to at least two grid conductors.
 - d. Inside grid, bond equipment reinforcing steel inside bases and sidewalks to at least two grid conductors.
 - e. Bond underground metal pipe and conduit passing under grid to nearest grid conductor at both ends.

E. Signal Reference Grid Tape Mesh:

1. Install tape mesh under floor finish with the following features:
 - a. Tape mesh, 2 inches by 16 mil solid copper, 12-inch 24 inch spacing.

3.3 SELECTION OF GROUNDING AND BONDING PRODUCTS FOR COMMUNICATIONS

- A. Comply with Section 270528 "Pathways for Communications Systems" and Section 271100 "Communications Equipment Room Fittings."

3.4 INSTALLATION OF GROUNDING AND BONDING

- A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.
2. Consult Architect for resolution of conflicting requirements.

C. Special Techniques:

1. Grounding and Bonding Conductors:

- a. Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- b. Underground Grounding Conductors:
 - 1) Bury at least 30 inches below grade.
 - 2) Duct-Bank Grounding Conductor: Bury 12 inch above duct bank when indicated as part of duct-bank installation.

2. Grounding and Bonding Connectors: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

- a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
- b. Make connections with clean, bare metal at points of contact.
- c. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
- d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
- e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- f. Bonding Straps and Jumpers: Install in locations accessible for inspection

and maintenance except where routed through short lengths of conduit.

- 1) Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate adjacent parts.
 - 2) Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3) Use exothermic-welded connectors for outdoor locations; if disconnect-type connection is required, use bolted clamp.
- g. Grounding and Bonding for Piping:
- 1) Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use bolted clamp connector or bolt lug-type connector to pipe flange by using one of lug bolts of flange. Where dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2) Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with bolted connector.
 - 3) Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- h. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- i. Grounding for Steel Building Structure: Install driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 ft apart.
3. Grounding and Bonding Busbars:
- a. Install busbar horizontally, on insulated spacers 2 inch minimum from wall, 6 inch above finished floor unless otherwise indicated.
 - b. Where busbars are indicated on both sides of doorways, route bonding conductor up to top of door frame, across top of doorway, and down; connect to continuation of horizontal busbar.
4. Electrodes:
- a. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1) Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2) Use exothermic welds for below-grade connections.
 - b. For grounding electrode system, install at least three <Insert number> rods spaced at least one-rod length from each other and located at least same distance from other grounding electrodes, and connect to service grounding

- electrode conductor.
- c. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and must be at least 12 inch deep, with cover.
 - 1) Install at least one test well for each service unless otherwise indicated. Install at ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
 - d. Ring Electrode: Install grounding conductor, electrically connected to each building structure ground rod and to each steel column indicated item, extending around perimeter of building area or item indicated.
 - 1) Install tinned-copper conductor not less than 2/0 AWG for ring electrode and for taps to building steel.
 - 2) Bury ring electrode not less than 24 inch from building's foundation.
 - e. Concrete-Encased Electrode (Ufer Ground):
 - 1) Fabricate in accordance with NFPA 70; use minimum of 20 ft of bare copper conductor not smaller than 4 AWG.
 - a) If concrete foundation is less than 20 ft long, coil excess conductor within base of foundation.
 - b) Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
 - 2) Fabricate in accordance with NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 ft long. If reinforcing is in multiple pieces, connect together by usual steel tie wires or exothermic welding to create required length.
5. Grounding at Service:
- a. Equipment grounding conductors and grounding electrode conductors must be connected to ground busbar. Install main bonding jumper between neutral and ground buses.
6. Grounding Separately Derived Systems:
- a. Permanent Generators: Install grounding electrode(s) at location of permanent generators having switched neutral connections. Electrode must be connected to equipment grounding conductor and to frame of generator.
7. Grounding Underground Distribution System Components:
- a. Comply with IEEE C2 grounding requirements.
 - b. Grounding Manholes and Handholes: Install driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inch will extend above finished floor. If necessary, install ground rod before manhole is placed and provide 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through waterproof sleeve in manhole wall. Protect ground

- rods passing through concrete floor with double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inch above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.
- c. Pad-Mounted Transformers and Switches: Install two ground rods and ring electrode around pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than 2 AWG for ring electrode and for taps to equipment grounding terminals. Bury ring electrode not less than 6 inches from foundation.

8. Equipment Grounding and Bonding:

- a. Install insulated equipment grounding conductors with feeders and branch circuits.
- b. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1) Feeders and branch circuits.
 - 2) Lighting circuits.
 - 3) Receptacle circuits.
 - 4) Single-phase motor and appliance branch circuits.
 - 5) Three-phase motor and appliance branch circuits.
 - 6) Flexible raceway runs.
 - 7) Armored and metal-clad cable runs.
- c. Water Heater: Install separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- d. Isolated Grounding Receptacle Circuits: Install insulated equipment grounding conductor connected to receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of applicable derived system or service unless otherwise indicated.
- e. Poles Supporting Outdoor Lighting Fixtures: Bond insulated equipment grounding conductor to equipment grounding terminal inside pole base.

3.5 PROTECTION

- A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 26 05 26

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Support, anchorage, and attachment components.
2. Fabricated metal equipment support assemblies.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Sockets.
 - e. Eye nuts.
 - f. Fasteners.
 - g. Anchors.
 - h. Saddles.
 - i. Brackets.
2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: Signed and sealed by a qualified professional engineer for fabrication and installation details for electrical hangers and support systems.

1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.

C. Delegated Design Submittals: For hangers and supports for electrical systems.

1. Include design calculations and details of hangers.
2. Include design calculations for seismic restraints.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified structural professional engineer to design hanger and support system.
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame Rating: Class 1.
 - 2. Self-extinguishing according to ASTM D635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABB, Electrification Business
 - b. Allied Tube & Conduit; Atkore International
 - c. Atkore Unistrut
 - d. B-Line; a division of Eaton, Electrical Sector
 - e. CADDY; brand of nVent Electrical plc
 - f. Flex-Strut Inc.
 - g. Gripple Inc.
 - h. G-Strut
 - i. Haydon Corporation
 - j. Metal Ties Innovation
 - k. MIRO Industries Inc.
 - l. Rocket Rack; Robroy Industries
 - m. Wesanco/ZSi-Foster; an Ideal Tridon Group Company
 - n. <Insert manufacturer's name>
 - 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 3. Material for Channel, Fittings, and Accessories: Galvanized steel Plain steel Stainless steel, Type 304 Stainless steel, Type 316.
 - 4. Channel Width: Selected for applicable load criteria *1-5/8 inch, 1-1/4-inch 13/16 inch.
 - 5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Conduit and Cable Support Devices: Steel, Steel and malleable-iron, Stainless steel,

Glass-fiber-resin hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body must be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 - 2. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 - 3. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
 - 4. Toggle Bolts: All Stainless-steel springhead type.
 - 5. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 SELECTION

- A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 - 1. NECA NEIS 101
 - 2. NECA NEIS 102.
 - 3. NECA NEIS 105.
 - 4. NECA NEIS 111.
- B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways specified in Section 260533.13 "Conduits for Electrical Systems."
- D. Comply with requirements for boxes specified in Section 260533.16 "Boxes and Covers

for Electrical Systems."

- E. Provide vibration and seismic controls with hangers and supports in accordance with requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems." "Section 260548.16 "Seismic Controls for Electrical Systems."
- F. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERMC as required by scheduled in NECA NEIS 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size must be 1/4 inch in diameter.
- G. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps single-bolt conduit clamps single-bolt conduit clamps using spring friction action for retention in support channel.
- H. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2 inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 INSTALLATION OF SUPPORTS

- A. Comply with NECA NEIS 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA NEIS 1, EMT IMC and ERMC may be supported by openings through structure members, in accordance with NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination must be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inch thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inch thick.
 - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69 Spring-tension clamps.
 - 7. To Light Steel: Sheet metal screws.

8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M. Submit welding certificates.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inch larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000 psi-28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup:
 1. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
 2. Comply with requirements in Section 099113 "Exterior Painting" *Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of

shop paint on miscellaneous metal.

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

END OF SECTION 26 05 29

SECTION 26 05 33.13
CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type HDPE and Type EPEC duct raceways and fittings.

B. Related Requirements:

1. Section 26 05 19 "Low-Voltage for Electrical Power Conductors and Cables" for nonmetallic underground conduit with conductors (Type NUCC).

1.2 DEFINITIONS

A. Conduit: A structure containing one or more duct raceways.

B. Duct Raceway: A single enclosed raceway for conductors or cable.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Type EMT-A and Type EMT-SS duct raceways and elbows.
2. Type EMT-S duct raceways and elbows.
3. Type ENT duct raceways and fittings.
4. Type HDPE and Type EPEC duct raceways and fittings.
5. Type ERMC-A and Type ERMC-SS duct raceways, elbows, couplings, and nipples.
6. Type ERMC-S duct raceways, elbows, couplings, and nipples.
7. Type FMC-S and Type FMC-A duct raceways.
8. Type FMT duct raceways.
9. Type IMC duct raceways.
10. Type LFMC duct raceways.
11. Type LFNC duct raceways.
12. Type PVC duct raceways and fittings.
13. Type RTRC-AG duct raceways and fittings.
14. Type RTRC-BG duct raceways and fittings.
15. Fittings for conduit, tubing, and cable.
16. Electrically conductive corrosion-resistant compounds for threaded conduit.
17. Solvent cements.

B. Sustainable design submittals.

1. Solvent cements.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions:

1. Type EMT-A and Type EMT-SS duct raceways and elbows.
2. Type EMT-S duct raceways and elbows.
3. Type ENT duct raceways and fittings.
4. Type HDPE and Type EPEC duct raceways and fittings.
5. Type ERMC-A and Type ERMC-SS duct raceways, elbows, couplings, and nipples.
6. Type ERMC-S duct raceways, elbows, couplings, and nipples.
7. Type FMC-S and Type FMC-A duct raceways.
8. Type FMT duct raceways.
9. Type IMC duct raceways.
10. Type LFMC duct raceways.
11. Type LFNC duct raceways.
12. Type PVC duct raceways and fittings.
13. Type RTRC-AG duct raceways and fittings.
14. Type RTRC-BG duct raceways and fittings.
15. Fittings for conduit, tubing, and cable.
16. Electrically conductive corrosion-resistant compounds for threaded conduit.
17. Solvent cements.

PART 2 - PRODUCTS

2.1 TYPE EMT-A AND TYPE EMT-SS DUCT RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN FJMX; including UL 797A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.2 TYPE EMT-S DUCT RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN FJMX; including UL 797.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.3 TYPE ENT DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN FKHU; including UL 1653.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.4 TYPE HDPE AND TYPE EPEC DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN EAZX; including UL 651A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL EAZX - Schedule 40 Electrical HDPE Underground Conduit (HDPE-40):

1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Blue Diamond Industries, LLC
 - b. JM Eagle
 - c. Petroflex North America
 - d. Prysmian Cables and Systems; Prysmian Group North America
 - e. Southwire Company, LLC
2. Dimensional Specifications: Schedule 40.
3. Options:

- a. Minimum Trade Size: Metric designator 16 (trade size 1/2) Metric designator 21 (trade size 3/4).

2.5 TYPE ERMC-A AND TYPE ERMC-SS DUCT RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DYWV; including UL 6A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.6 TYPE ERMC-S DUCT RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DYIX; including UL 6.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.7 TYPE FMC-S AND TYPE FMC-A DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DXUZ; including UL 1.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.8 TYPE FMT DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN ILJW; including UL Subject 1652.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.9 TYPE IMC DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DYBY; including UL 1242.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.10 TYPE LFMC DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DXHR; including UL 360.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.11 TYPE LFNC DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DXOQ; including UL 1660.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.12 TYPE PVC DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DZYR; including UL 651.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.13 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.14 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2. Listing Criteria: UL CCN FOIZ; including UL Subject 2419.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.15 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DWTT; including UL 514B.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

PART 3 - EXECUTION

3.1 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.
- B. Special Instructions Regarding HDPE Conduits: Although Article 353 of NFPA 70 permits use of HDPE conduits where encased in concrete aboveground, UL CCN EAZX listing requirements state that HDPE and EPEC underground conduits are intended only for use where direct buried with or without being encased in concrete. Specified Type HDPE and Type EPEC underground conduits are not permitted to be used aboveground on Project.
- C. Outdoors:
1. Exposed and Subject to Severe Physical Damage: ERMIC IMC.
 2. Exposed and Subject to Physical Damage: ERMIC IMC Corrosion-resistant EMT.
 - a. Locations less than 2.5 m (8 ft) above finished floor.
 3. Exposed and Not Subject to Physical Damage: ERMIC IMC Corrosion-resistant EMT PVC-80 RTRC-AG.
 4. Concealed Aboveground: ERMIC IMC, EMT PVC-80, PVC-40, RTRC-AG.
 5. Direct Buried: PVC-80, PVC-40, HDPE-80, HDPE-40, RTRC-BG.
 6. Concrete Encased Not in Trench: PVC-80, PVC-40, PVC-A, RTRC-BG.

7. Concrete Encased in Trench: PVC-80, PVC-40, PVC-A, PVC-EB, HDPE-80, HDPE-40, EPEC-A, EPEC-B, RTRC-BG.
 8. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC, LFNC-A, LFNC-B.
- D. Indoors:
1. Hazardous Classified Locations: ERMIC & IMC.
 2. Exposed and Subject to Severe Physical Damage: ERMIC IMC. Locations include the following:
 - a. Loading docks.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums.
 3. Exposed and Subject to Physical Damage: ERMIC IMC EMT. Locations include the following:
 - a. Locations less than 2.5 m (8 ft) above finished floor.
 - b. Stub-ups to above suspended ceilings.
 4. Exposed and Not Subject to Physical Damage: ERMIC IMC EMT PVC-80 RTRC-AG.
 5. Concealed in Ceilings and Interior Walls and Partitions: ERMIC IMC EMT PVC-80 PVC-40 RTRC-AG.
 6. Damp or Wet Locations: ERMIC IMC RTRC-AG Corrosion-resistant EMT.
 7. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC FMC LFNC-A LFNC-B.
 8. Circuits Operating Above 60 Hz: EMT-A ERMIC-A RTRC-AG. Provide nonmetallic sleeve where aluminum duct raceways pass through concrete.
- E. Duct Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
1. ERMIC and IMC: Provide threaded-type fittings unless otherwise indicated.

3.2 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
1. Type EMT-A: Article 358 of NFPA 70 and NECA NEIS 102.
 2. Type EMT-SS: Article 358 of NFPA 70 and NECA NEIS 101.
 3. Type EMT-S: Article 358 of NFPA 70 and NECA NEIS 101.
 4. Type ENT: Article 362 of NFPA 70 and NECA NEIS 102.
 5. Type HDPE and Type EPEC: Article 353 of NFPA 70 and NECA NEIS 111.
 6. Type ERMIC-A: Article 344 of NFPA 70 and NECA NEIS 102.
 7. Type ERMIC-SS: Article 344 of NFPA 70 and NECA NEIS 101.

8. Type ERMC-S: Article 344 of NFPA 70 and NECA NEIS 101.
9. Type FMC-S: Article 348 of NFPA 70 and NECA NEIS 101.
10. Type FMC-A: Article 348 of NFPA 70 and NECA NEIS 102.
11. Type FMT: Article 360 of NFPA 70 and NECA NEIS 101.
12. Type IMC: Article 342 of NFPA 70 and NECA NEIS 101.
13. Type LFMC: Article 350 of NFPA 70 and NECA NEIS 101.
14. Type LFNC: Article 342 of NFPA 70 and NECA NEIS 111.
15. Type PVC: Article 356 of NFPA 70 and NECA NEIS 111.
16. Type RTRC: Article 355 of NFPA 70 and NECA NEIS 111.
17. Expansion Fittings: NEMA FB 2.40.
18. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. General Requirements for Installation of Duct Raceways:
 - a. Complete duct raceway installation before starting conductor installation.
 - b. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft above finished floor.
 - c. Install no more than equivalent of three 90-degree bends in conduit run except for control wiring conduits, for which no more than equivalent of two 90-degree fewer bends are permitted. Support within 12 inch of changes in direction.
 - d. Make bends in duct raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
 - e. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
 - f. Support conduit within 12 inches of enclosures to which attached.
 - g. Install duct sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed duct raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install duct sealing fittings in accordance with NFPA 70.
 - h. Install devices to seal duct raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of duct raceways at the following points:
 - 1) Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2) Where an underground service duct raceway enters a building or structure.
 - 3) Conduit extending from interior to exterior of building.
 - 4) Conduit extending into pressurized duct raceway and equipment.
 - 5) Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 - 6) Where otherwise required by NFPA 70.
 - i. Do not install duct raceways or electrical items on "explosion-relief" walls or rotating equipment.
 - j. Do not install conduits within 2 inches of the bottom side of a metal deck roof.
 - k. Keep duct raceways at least 6 inches away from parallel runs of flues and

- steam or hot-water pipes. Install horizontal duct raceway runs above water and steam piping.
- I. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
 - m. Install pull wires in empty duct raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb. tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground duct raceways designated as spare above grade alongside duct raceways in use.
 - n. Install duct raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
 - 1) Termination fittings with shoulders do not require two locknuts.
 - o. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
2. Types EMT-A, ERMCA, and FMC-A: Do not install aluminum duct raceways or fittings in contact with concrete or earth.
 3. Types ERMCA and IMC:
 - a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of duct raceway and fittings before making up joints. Follow compound manufacturer's published instructions.
 4. Type ERMCA-S-PVC:
 - a. Follow manufacturer's installation instructions for clamping, cutting, threading, bending, and assembly.
 - b. Provide PVC-coated sealing locknut for exposed male threads transitioning into female NPT threads that do not have sealing sleeves, including transitions from PVC couplings/female adapters to Type ERMCA-S-PVC elbows in direct-burial applications. PVC-coated sealing locknuts must not be used in place of conduit hub. PVC-coated sealing locknut must cover exposed threads on Type ERMCA-S-PVC duct raceway.
 - c. Coat field-cut threads on PVC-coated duct raceway with manufacturer-approved corrosion-preventing conductive compound prior to assembly.
 5. Types FMC, LFMC, and LFNC:
 - a. Provide a maximum of 36 inch or 72 inches of flexible conduit for recessed and semi recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 6. Types PVC, HDPE, and EPEC:
 - a. Do not install Type PVC, Type HDPE, or Type EPEC conduit where ambient temperature exceeds 122 deg F. Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete

- encasement, where 90 deg C conductors are permitted.
 - b. Comply with manufacturer's published instructions for solvent welding and fittings.
7. Type RTRC: Do not install Type RTRC conduit where ambient temperature exceeds 230 deg F.
8. Duct Raceways Embedded in Slabs:
- a. Run duct raceways larger than metric designator 27 (trade size 1) below concrete slab. Run duct raceways larger than metric designator 27 (trade size 1) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place duct raceway close to slab support. Secure duct raceways to reinforcement at maximum 10 ft intervals.
 - b. Arrange duct raceways to cross building expansion joints with expansion fittings at right angles to the joint.
 - c. Arrange duct raceways to ensure that each is surrounded by minimum of 1 inch or 2 inches of concrete without voids.
 - d. Do not embed threadless fittings in concrete unless locations have been specifically approved by Architect.
 - e. Change from ENT to PVC-80, PVC-40, ERM, or IMC before rising above floor.
9. Stub-ups to Above Recessed Ceilings:
- a. Provide EMT, IMC, or ERM for duct raceways.
 - b. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
10. Duct Raceway Terminations at Locations Subject to Moisture or Vibration:
- a. Provide insulating bushings to protect conductors, including conductors smaller than 4 AWG. Install insulated throat metal grounding bushings on service conduits.
11. Duct Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.
- a. ERM-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - b. EMT: Provide setscrew, compression, steel, cast-metal fittings. Comply with NEMA FB 2.10.
 - c. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.
12. Expansion-Joint Fittings:
- a. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F and that have straight-run length that exceeds 25 ft. Install in runs of aboveground ERM and EMT conduit that are located where environmental temperature change may exceed 100 deg F and that have straight-run length that exceeds 100 ft.
 - b. Install type and quantity of fittings that accommodate temperature change listed for the following locations:

- 1) Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - 2) Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - 3) Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - 4) Attics: 135 deg F temperature change.
- c. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.00078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 - d. Install expansion fittings at locations where conduits cross building or structure expansion joints.
 - e. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's published instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
13. Duct Raceways Penetrating Rooms or Walls with Acoustical Requirements: Seal duct raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.
 14. Identification: Provide labels for conduit assemblies, duct raceways, and associated electrical equipment.
 - a. Provide warning signs.
- D. Interfaces with Other Work:
1. Coordinate installation of new products for product with existing conditions.
 2. Coordinate with Section 078413 "Penetration Firestopping" for installation of firestopping at penetrations of fire-rated floor and wall assemblies.
 3. Coordinate with Section 260529 "Hangers and Supports for Electrical Systems" for installation of conduit hangers and supports.

3.3 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33.13

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: For each piece of electrical equipment and electrical system components to be index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 LABELS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN PGDQ2 for components; including UL 969.

B. UL PGDQ2 - Vinyl Wraparound Labels: Preprinted, flexible labels laminated with clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturers: Subject to compliance with requirements, provide products by the following, provide products by one of the following, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Brady Corporation
 - b. Champion America
 - c. Emedco
 - d. Grafoplast Wire Markers
 - e. HellermannTyton
 - f. LEM Products Inc.
 - g. Marking Services Inc.

- h. Panduit Corp
- i. Seton Identification Products; a Brady Corporation company

2.2 EXTRUDED INSULATING TUBING

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN YDPU2 for components; including UL 224.

2.3 TAPES AND STENCILS

A. Concrete Cable Route Markers <Insert drawing designation>:

1. Description: Concrete markers visually aid tracing the route of electrical cables. Monument markers are typically installed at grade. Protective cover markers are typically installed above the cables at grade or below grade.
2. Product Characteristics:
 - a. Material: Precast reinforced concrete.
 - b. Marker Type:
 - 1) Above-Ground Monument Post:
 - a) Nominal Dimensions (Height, Width, Depth): 30 inch, 6 inch, 3 inch.
 - 2) Above-Ground Monument Block:
 - a) Nominal Dimensions (Height, Width, Depth): 12 inch, 12 inch, 6 inch, 24 inch, 24 inch, 4 inch.
 - 3) In-Ground Protective Cover (Plank or Slab):
 - a) Nominal Dimensions (Length, Width, Depth): 36 inch, 6 inch, 2 inch, 36 inch, 9 inch, 2 inch, 12 inch, 12 inch, 2 inch, 24 inch, 12 inch, 2 inch, 36 inch, 12 inch, 2 inch.
 - c. Legend: "DANGER - ELECTRICITY", "ELECTRIC CABLES", "ELECTRIC SPLICE".
 - d. Lettering: Approximately 1/8 inch deep, not less than 1 inch or 1.5 inch high, symmetrically spaced; marked on both sides to allow for reversal.
3. Required Product Options:
 - a. Color: Red dye added to concrete during batching.
 - b. Attach metal medallion or sign stamped with feeder number.

- B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height must be 1 inch.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 SELECTION OF COLORS AND IDENTIFICATION MARKINGS

- A. Comply with 29 CFR 1910.144 for color identification of hazards, and the following:
 - 1. Fire-protection and fire-alarm equipment, including raceways, must be finished, painted, or suitably marked safety red.
 - 2. Ceiling-mounted hangers, supports, cable trays, and raceways must be finished, painted, or suitably marked safety yellow where less than 7.7 ft above finished floor.
- B. Pipe and Conduit Labeling: Comply with ASME A13.1 and IEEE C2.
- C. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
 - 1. Color must be factory applied or field applied for sizes larger than 6 AWG when permitted by authorities having jurisdiction.
 - 2. Colors for 208Y/120 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 240 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - 4. Colors for 480Y/277 V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 5. Color for Neutral (Grounded Conductor): White or gray.
 - 6. Color for Equipment Ground: Bare copper, Green, Green with yellow stripe.
 - 7. Color for Isolated Ground: Green with two or more yellow stripes.
- D. Color-Coding Raceways, Cable Trays, Junction Boxes, and Conductors for Intrinsically Safe Circuits: Light blue. When used to identify intrinsically safe circuits, Article 504 of NFPA 70 requires that the color light blue not be used for any other purpose.
- E. Color-Coding Instructional Signs: Self-adhesive labels, including color code for grounded and ungrounded conductors.

- F. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage. System legends must be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."
- G. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- H. Locations of Underground Lines: Underground-line warning tape for power and lighting.
- I. Vaults, Manholes, Handholes, and Pull and Junction Boxes, More Than 1000 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use write-on tags nonmetallic preprinted tags colored and marked to indicate phase, and separate tag with circuit designation.
- J. Concealed Raceways, Duct Banks, More Than 1000 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3 inch high, black letters on 20 inch centers.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, and at 10 ft, 30 ft, maximum intervals.
 - 2. Identify system voltage and system or service type with black letters on orange field.
 - 3. Apply floor marking tape to the following finished surfaces:
 - a. Floor surface directly above conduits running beneath and within 12 inch of floor that is in contact with earth or is framed above unexcavated space.
 - b. Wall surfaces directly external to raceways concealed within wall.
 - c. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in building, or concealed above suspended ceilings.
- K. Accessible Raceways, Armored and Metal-Clad Cables, More Than 1000 V: Vinyl wraparound labels, Snap-around labels, Self-adhesive labels, Snap-around color-coding bands for raceway and cables.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.
 - 2. Identify system voltage and system or service type with black letters on orange field.
- L. Vaults, Manholes, Handholes, and Pull and Junction Boxes, 1000 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels, self-adhesive wraparound labels, snap-around labels, snap-around color-coding bands, self-adhesive vinyl tape to identify phase.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.
 - 2. Identify system voltage and system or service type with black letters on orange field.

- M. Accessible Raceways and Metal-Clad Cables, 1000 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 and 120 V to Ground: Identify with self-adhesive raceway labels vinyl tape applied in bands.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.
 - 2. Identify system voltage and system or service type with black letters on orange field.

- N. Conductors to Be Extended in Future: Attach write-on tags, marker tape to conductors, and list source.

- O. Cover Plates: Label individual cover plates with self-adhesive labels. Place label at top of cover plate. Label cover plate with the following information, in the order listed:
 - 1. Panelboard designation.
 - 2. Colon or dash.
 - 3. Branch circuit number.

- P. Workspace Indication: Apply floor marking tape or tape and stencil to finished surfaces. Show working clearances in direction of access to live parts. Workspace must comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

- Q. Equipment Identification Labels:
 - 1. Black letters on white field.
 - 2. Indoor Equipment: Self-adhesive label, Baked-enamel signs, Metal-backed butyrate signs, Laminated acrylic or melamine plastic sign.
 - 3. Outdoor Equipment: Laminated acrylic or melamine sign, Stenciled legend 4 inch high.
 - 4. Equipment to Be Labeled:
 - a. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels containing equipment designation.
 - b. Panelboards: Typewritten directory of circuits in location provided by panelboard manufacturer. Panelboard identification must be in form of self-adhesive, engraved, engraved, laminated acrylic or melamine label.
 - c. Enclosures and electrical cabinets.
 - d. Access doors and panels for concealed electrical items.
 - e. Switchgear.
 - f. Switchboards.
 - g. Transformers: Label that includes tag designation indicated on Drawings for transformer, feeder, and panelboards or equipment supplied by secondary.
 - h. Substations.
 - i. Emergency system boxes and enclosures.
 - j. Motor-control centers.
 - k. Enclosed switches.
 - l. Enclosed circuit breakers.
 - m. Enclosed controllers.
 - n. Variable-speed controllers.
 - o. Push-button stations.
 - p. Power-transfer equipment.
 - q. Contactors.

- r. Remote-controlled switches, dimmer modules, and control devices.
- s. Uninterruptible power supplies.
- t. Battery-inverter units.
- u. Battery racks.
- v. Power-generating units.
- w. Monitoring and control equipment.

R. Cable Ties: General purpose, for attaching tags, except as listed below:

- 1. Outdoors: UV-stabilized nylon.
- 2. In Spaces Handling Environmental Air: Plenum rated.

3.3 SELECTION OF IDENTIFICATION PRODUCTS FOR COMMUNICATIONS, CONTROL, AUXILIARY, AND LIFE SAFETY SYSTEMS

A. Comply with Section 270528 "Pathways for Communications Systems" and Section 271100 "Communications Equipment Room Fittings."

3.4 INSTALLATION

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes typical for electrical equipment environments specified in Section 260011 "Facility Performance Requirements for Electrical."
- C. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- D. Fasteners for Labels and Signs: Self-tapping, stainless steel screws, or stainless-steel machine screws with nuts and flat and lock washers.
- E. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- F. Install identifying devices before installing acoustical ceilings and similar concealment.
- G. Verify identity of item before installing identification products.
- H. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- I. Apply identification devices to surfaces that require finish after completing finish work.
- J. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.
- L. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.
- M. Snap-Around Labels: Secure tight to surface at location with high visibility and accessibility.
- N. Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and accessibility.
- O. Snap-Around Color-Coding Bands: Secure tight to surface at location with high visibility and accessibility.
- P. Heat-Shrink, Preprinted Tubes: Secure tight to surface at location with high visibility and accessibility.
- Q. Marker Tapes: Secure tight to surface at location with high visibility and accessibility.
- R. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for minimum distance of 6 inch where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- S. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- T. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's instructions.
- U. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape not less than 12 inches directly above cables or raceways buried 18 inch or more below grade. Use multiple tapes where width of multiple lines installed in common trench or concrete envelope exceeds 16 inch overall.
 - 2. Limit use of underground-line warning tape to direct-buried cables.
 - 3. Install underground-line warning tape for direct-buried cables and cables in raceways.
- V. Concrete Cable Route Markers: As indicated on Drawings.
- W. Metal Tags:
 - 1. Place in location with high visibility and accessibility.
 - 2. Secure using general-purpose, UV-stabilized, plenum-rated cable ties.
- X. Nonmetallic Preprinted Tags:

1. Place in location with high visibility and accessibility.
2. Secure using general-purpose UV-stabilized plenum-rated cable ties.

Y. Write-on Tags:

1. Place in location with high visibility and accessibility.
2. Secure using general-purpose UV-stabilized plenum-rated cable ties.

Z. Baked-Enamel Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

AA. Metal-Backed Butyrate Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

BB. Laminated Acrylic or Melamine Plastic Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

END OF SECTION 26 05 53

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electronic dial-time switches.
2. Indoor occupancy and vacancy sensors.
3. Conductors and cables.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Electronic dial-time switches.
2. Electromechanical dial-time switches.
3. Outdoor photoelectric switches, solid state, flexible mounting.
4. Outdoor photoelectric switches, solid state, luminaire mounted.
5. Daylight-harvesting switching controls.
6. Daylight-harvesting dimming controls, analog.
7. Daylight-harvesting dimming controls, digital.
8. Indoor occupancy and vacancy sensors.
9. Switchbox-mounted occupancy sensors.
10. Digital timer light switch.
11. Outdoor motion sensors.
12. Lighting contactors.
13. Emergency shunt relay.
14. Conductors and cables.

B. Shop Drawings:

1. Show installation details for the following:
 - a. Occupancy sensors.
 - b. Vacancy sensors.

C. Field quality-control reports.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's warranties.

1.4 WARRANTY

- A. Special Extended Warranty: Manufacturer and Installer warrant that installed lighting control devices perform in accordance with specified requirements and agree to repair or replace, including labor, materials, and equipment, devices that fail to perform as

specified within extended warranty period.

1. Failures include, but are not limited to, the following:
 - a. Faulty operation of lighting control software.
 - b. Faulty operation of lighting control devices.
2. Extended Warranty Period: Three year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 No. 22 No. 24 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14, No. 16, No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SENSORS

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's instructions.

3.3 INSTALLATION OF CONTACTORS

- A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.4 INSTALLATION OF WIRING

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- B. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's instructions.
- C. Size conductors in accordance with lighting control device manufacturer's instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, device, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 IDENTIFICATION

- A. Identify components and power and control wiring in accordance with Section 260553 "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.6 FIELD QUALITY CONTROL

- A. Field tests must be witnessed by Architect, or Tenant authorities having jurisdiction.
- B. Tests and Inspections:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Nonconforming Work:
 - 1. Lighting control devices will be considered defective if they do not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- D. Prepare test and inspection reports.
- E. Manufacturer Services:

1. Engage factory-authorized service representative to support supervise field tests and inspections.

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.8 MAINTENANCE

- A. Software and Firmware Service Agreement:
 1. Technical Support: Beginning at Substantial Completion, verify that software and firmware service agreement include software support for two years.
 2. Upgrade Service: At Substantial Completion, update software and firmware to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Verify upgrading software includes operating system and new or revised licenses for using software.
 - a. Upgrade Notice: No fewer than 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.
 3. Upgrade Reports: Prepare written report after each update, documenting upgrades installed.

END OF SECTION 26 09 23

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Power panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Disconnecting and overcurrent protective devices.

1.2 DEFINITIONS

- A. MCCB: Molded-case circuit breaker.
- B. VPR: Voltage protection rating.

1.3 CLOSEOUT SUBMITTALS

- A. Warranty documentation.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Spare Parts: Furnish to Owner spare parts, for repairing panelboards, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:
1. Keys: Two spares for each type of panelboard cabinet lock.
 2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.
 3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
- B. Special Tools: Furnish to Owner proprietary equipment, keys, and software required to operate, maintain, repair, adjust, or implement future changes to panelboards, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:

1.5 WARRANTY

- A. Special Installer Extended Warranty: Installer warrants that fabricated and installed panelboards perform in accordance with specified requirements and agrees to repair or replace components or products that fail to perform as specified within extended-warranty period.
1. Extended-Warranty Period: Five years from date of Substantial Completion; full coverage for labor, materials, and equipment.

- B. Special Manufacturer Extended Warranty: Manufacturer warrants that panelboards perform in accordance with specified requirements and agrees to provide repair or replacement of components or products that fail to perform as specified within extended-warranty period.
 - 1. Initial Extended-Warranty Period: Four years from date of Substantial Completion; full prorated coverage for labor, materials, and equipment.
 - 2. Follow-On Extended-Warranty Period Five years from date of Substantial Completion; full prorated coverage for materials that failed because of transient voltage surges only, free on board, origin, destination, freight prepaid.

PART 2 - PRODUCTS

2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

- A. Fabricate and test panelboards in accordance with IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing agency recognized by authorities having jurisdiction and marked for intended location and application.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.
- F. Enclosures: Flush and Surface-mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a- Indoor Dry and Clean Locations: UL 50E, Type 1
 - b- Outdoor Locations: UL 50E, Type 3R
 - c. Kitchen, Wash-Down Areas: UL 50E Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: UL 50E, Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: UL 50E, Type 5, Type 12.
 - 2. Height: 7 ft maximum.
 - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims must cover live parts and may have no exposed hardware.
 - 4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims must cover live parts and may have no exposed hardware.
 - 5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 - 6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 7. Finishes:

- a. Panels and Trim: Steel and factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel, Same finish as panels and trim.
 - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
- G. Incoming Mains:
- 1. Location: Top Convertible between top and bottom.
 - 2. Main Breaker: Main lug interiors up to 400 A must be field convertible to main breaker.
- H. Phase, Neutral, and Ground Buses:
- 1. Material: Hard-drawn copper, 98 percent conductivity.
 - a. Plating must run entire length of bus.
 - b. Bus must be fully rated for entire length.
 - 2. Interiors must be factory assembled into unit. Replacing switching and protective devices may not disturb adjacent units or require removing main bus connectors.
 - 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
 - 5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure.
 - 6. Do not mount neutral bus in gutter.
 - 7. Split Bus: Vertical buses divided into individual vertical sections.
- I. Conductor Connectors: Suitable for use with conductor material and sizes.
- 1. Material: Tin-plated aluminum, Hard-drawn copper, 98 percent conductivity.
 - 2. Terminations must allow use of 75 deg C rated conductors without derating.
 - 3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
 - 4. Main and Neutral Lugs, Mechanical type, with lug on neutral bar for each pole in panelboard.
 - 5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with lug on bar for each pole in panelboard.
 - 6. Feed-Through Lugs, Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 7. Subfeed (Double) Lugs, Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - 8. Gutter-Tap Lugs, Mechanical type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.
 - 9. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- J. Quality-Control Label: Panelboards or load centers must be labeled, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers must have meter enclosures, wiring,

connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

- K. Future Devices: Panelboards or load centers must have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
 - 1. Percentage of Future Space Capacity: 20 percent.
- L. Panelboard Short-Circuit Current Rating:
 - 1. Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by qualified electrical testing laboratory recognized by authorities having jurisdiction. Include label or manual with size and type of allowable upstream and branch devices listed and labeled, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for series-connected short-circuit rating.
 - a. Panelboards rated 240 V or less must have short-circuit ratings as shown on Drawings, but not less than 10 000 A(rms) symmetrical.
 - b. Panelboards rated above 240 V and less than 600 V must have short-circuit ratings as shown on Drawings, but not less than 14 000 A(rms) symmetrical.
 - 2. Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for 100 percent interrupting capacity.
 - a. Panelboards and overcurrent protective devices rated 240 V or less must have short-circuit ratings as shown on Drawings, but not less than 10 000 A(rms) symmetrical.
 - b. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V must have short-circuit ratings as shown on Drawings, but not less than 14 000 A(rms) symmetrical.
- M. Surge Suppression: Factory installed as integral part of indicated panelboards, complying with UL 1449 SPD, Type 1, Type 2

2.2 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following: provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Square D; Schneider Electric USA
 - 2. ABB, Electrification Business
 - 3. Eaton
 - 4. Siemens Industry, Inc., Energy Management Division
- B. Listing Criteria: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1. For doors more than 36 inch high, provide two latches, keyed alike.

- D. Mains: Circuit breaker.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Square D; Schneider Electric USA
 - 2. ABB, Electrification Business
 - 3. Eaton
 - 4. Siemens Industry, Inc., Energy Management Division
- B. Listing Criteria: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only.
- D. Branch Overcurrent Protective Devices: Plug-in Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Door-in-door construction with concealed hinges; secured with flush or multipoint latch with tumbler lock; keyed alike. Outer door must permit full access to panel interior. Inner door must permit access to breaker operating handles and labeling, but current carrying terminals and bus must remain concealed.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Square D; Schneider Electric USA
 - 2. ABB, Electrification Business
 - 3. Eaton
 - 4. Siemens Industry, Inc., Energy Management Division
- B. MCCB: Comply with UL 489, with series-connected rating interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:
 - a. RMS sensing.
 - b. Field-replaceable rating plug or electronic trip.
 - c. Digital display of settings, trip targets, and indicated metering displays.
 - d. Multi-button keypad to access programmable functions and monitored data.
 - e. Ten-event, trip-history log. Each trip event must be recorded with type, phase, and magnitude of fault that caused trip.
 - f. Integral test jack for connection to portable test set or laptop computer.
4. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6 mA trip).
5. Subfeed Circuit Breakers: Vertically mounted.
6. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards in accordance with NECA 407 NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's published instructions.
- B. Reference Standards:
 1. Panelboards: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NECA 407 NEMA PB 1.1.
 2. Consult Architect for resolution of conflicting requirements.
- C. Special Techniques:

1. Equipment Mounting:

- a. Attach panelboard to vertical finished or structural surface behind panelboard.
- b. Mount surface-mounted panelboards to steel slotted supports 5/8 inch 1-1/4 inch in depth. Orient steel slotted supports vertically.

2. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

3. Mount top of trim 7.5 ft above finished floor unless otherwise indicated.

4. Mount panelboard cabinet plumb and rigid without distortion of box.

5. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

6. Install overcurrent protective devices and controllers not already factory installed.

- a. Set field-adjustable, circuit-breaker trip ranges.
- b. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver in accordance with manufacturer's published instructions.

7. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

8. Install filler plates in unused spaces.

9. Stub four 1 inch empty conduits from panelboard 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 not on grade.

10. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

11. Mount spare fuse cabinet in accessible location.

D. Interfaces with Other Work:

1. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."
- B. Panelboard Nameplates: Label each panelboard with nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- C. Device Nameplates: Label each branch circuit device in power panelboards with nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Install warning signs complying with requirements in Section 260553 "Identification for

Electrical Systems" identifying source of remote circuit.

- E. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles must be located on interior of panelboard door.
- F. Breaker Labels: Faceplate must list current rating, UL and IEC certification standards, and AIC rating.
- G. Circuit Directory:
 - 1. Provide directory card inside panelboard door, mounted in transparent card holder metal frame with transparent protective cover.
 - a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.
 - 2. Provide computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
 - a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.
 - 3. Create directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

3.4 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Field tests and inspections must be witnessed by Architect Tenant authorities having jurisdiction.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers and low-voltage surge arrestors stated in NETA ATS, Paragraph 7.6 Circuit Breakers and Paragraph 7.19.1 Surge Arrestors, Low-Voltage. Do not perform optional tests. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.

c. Instruments and Equipment:

- 1) Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Nonconforming Work:

1. Panelboards will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

- E. Collect, assemble, and submit test and inspection reports, including certified report that identifies panelboards included and that describes scanning results, with comparisons of two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

F. Manufacturer Services:

1. Engage factory-authorized service representative to support supervise field tests and inspections.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

- B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.

1. Measure loads during period of normal facility operations.
2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within panelboard, may not exceed 20 percent.

3.6 PROTECTION

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature in accordance with manufacturer's published instructions.

END OF SECTION 26 24 16

SECTION 26 27 16
ELECTRICAL CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 DEFINITIONS

- A. RBB: Rack bonding busbar, located in equipment cabinets and racks.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Cabinets and cutout boxes.
 - 2. Termination boxes.
 - 3. Miscellaneous enclosures.
 - 4. Rack or frame systems.
 - 5. Enclosure-mounted relocatable power taps.
- B. Shop Drawings:
 - 1. Shop drawings for custom enclosures and cabinets.
 - 2. Shop drawings for racks or frames.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturers' Published Instructions:
 - 1. Cabinets and cutout boxes.
 - 2. Termination boxes.
 - 3. Miscellaneous enclosures.
 - 4. Rack or frame systems.
 - 5. Enclosure-mounted relocatable power taps.

PART 2 - PRODUCTS

2.1 CABINETS AND CUTOOUT BOXES

A. Performance Criteria:

1. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2. Listing Criteria:

- a. UL CCN CYIV.
- b. Non-Environmental Characteristics: UL 50.
- c. Environmental Characteristics: UL 50E.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.2 TERMINATION BOXES

- #### A. Description: Enclosure for termination base consisting of lengths of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors or both.

B. Performance Criteria:

1. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2. Listing Criteria:

- a. UL CCN XCKT; including UL 1773.
- b. Non-Environmental Characteristics: UL 50.
- c. Environmental Characteristics: UL 50E.

C. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.3 MISCELLANEOUS ENCLOSURES

A. Performance Criteria:

1. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2. Listing Criteria:

- a. UL CCN XCKT; including UL 1773.
- b. Non-Environmental Characteristics: UL 50.
- c. Environmental Characteristics: UL 50E.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.4 RACK OR FRAME SYSTEMS

- A. Description: This category covers rack or frame systems that are not complete but include components and assemblies that are intended to power, protect, heat, cool, or otherwise support electrical or electronic equipment that will be installed at a later time.

B. Performance Criteria:

1. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2. Listing Criteria:

- a. UL CCN NWIN; including UL 2416.
- b. Non-Environmental Characteristics: UL 50.
- c. Environmental Characteristics: UL 50E or UL 2416.

C. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.5 ENCLOSURE-MOUNTED RELOCATABLE POWER TAPS

- A. Description: This category covers relocatable power taps rated 250 V(ac) or less, 20 A or

less, and intended to supply power to cord-and-plug-connected electrical utilization equipment located inside cabinets, enclosures, and racks.

B. Performance Criteria:

1. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2. Listing Criteria: UL CCN XBYS; including UL 1363.

C. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

PART 3 - EXECUTION

3.1 PREPARATION

A. Shop Drawings: Prepare and submit the following:

1. Shop Drawings for Custom Enclosures and Cabinets: Include plans, elevations, sections, and attachment details.
2. Shop Drawings for Racks or Frames:
 - a. Include plans, elevations, sections, details, and attachments to other work.
 - b. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - c. Include workspace requirements and access for cable connections.
 - d. Grounding: Indicate location of RBB and its mounting detail showing standoff insulators and wall-mounting brackets.

3.2 SELECTION OF ELECTRICAL CABINETS AND ENCLOSURES

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of electrical cabinets and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:

1. Outdoors:
 - a. Type 3R Type 4 Type 3 unless otherwise indicated.
 - b. Locations Exposed to Hosedown: Type 4 Type 6 Type 6P.
 - c. Locations Subject to Potential Flooding: Type 6P.
 - d. Locations Aboveground Where Mechanism Must Operate When Ice

- Covered: Type 3S.
- e. Locations in-Ground or Exposed to Corrosive Agents: Type 4X Type 6P Type 3RX.
 - f. Locations in-Ground or Exposed to Corrosive Agents Where Mechanism Must Operate When Ice Covered: Type 3SX.

2. Indoors:

- a. Type 1 unless otherwise indicated.
- b. Damp or Dusty Locations: Type 12 Type 2 Type 4 Type 5.
- c. Surface Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
- d. Flush Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12 Type 12K.
- e. Locations Exposed to Airborne Dust, Lint, Fibers, or Flyings: Type 4 Type 6.
- f. Locations Exposed to Hosedown: Type 4 Type 6 Type 6P.
- g. Locations Exposed to Brief Submersion: Type 6 Type 6P.
- h. Locations Exposed to Prolonged Submersion: Type 6P.
- i. Locations Exposed to Corrosive Agents: Type 4X Type 6P.
- j. Locations Exposed to Spraying Oil or Coolants: Type 13.

3.3 INSTALLATION OF ELECTRICAL CABINETS AND ENCLOSURES

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
 - 1. Cabinets and Cutout Boxes: Article 312 of NFPA 70.
 - 2. Consult Architect for resolution of conflicting requirements.
- C. Special Installation Techniques:
 - 1. Mount cabinets and enclosures at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center top bottom of box unless otherwise indicated.
 - 2. Do not install cabinets, enclosures, or fittings in contact with concrete or earth.
 - 3. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
 - 4. Identification: Provide labels for cabinets, enclosures, racks and associated electrical equipment.
 - a. Identify field-installed conductors, interconnecting wiring, and components.
 - b. Provide warning signs.
 - c. Label each cabinet, enclosure, and rack with engraved metal or laminated-plastic nameplate.
- D. Interfaces with Other Work:
 - 1. Coordinate installation of new products for <Insert system or product family/category> with existing conditions.

- a. <Insert requirements for transition between new and existing>.
2. Coordinate with Section 078413 "Penetration Firestopping" for installation of sealants.
3. Grounding and Bonding:
 - a. Cabinets, Enclosures, and Racks for Electrical Systems: Coordinate with Section 260526 "Grounding and Bonding for Electrical Systems" for grounding of RBBs.
 - b. Cabinets, Enclosures, and Racks for Communications Systems and Electronic Safety and Security Systems: Coordinate with Section 260526 "Grounding and Bonding for Electrical Systems" for grounding of RBBs.
4. Coordinate with Section 260573.13 "Short-Circuit Studies" for determining available fault current on input feeder.
5. Coordinate with Section 260573.19 "Arc-Flash Hazard Analysis" for determining arc-flash hazard on input feeder.
6. Coordinate with <Insert Section number and title> for <Insert description of interfacing related Work>.
 - a. <Insert requirements for transition between this Section and related Work>.

3.4 CLEANING

- A. Remove construction dust and debris from cabinets, enclosures, and racks.

3.5 PROTECTION

- A. Protect coatings and finishes of cabinets, enclosures, and racks from damage and deterioration.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 27 16

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- I. General-grade duplex straight-blade receptacles.

1.2 ALLOWANCES

- A. See Section 012100 "Allowances" for description of allowances affecting items specified in this Section.

1.3 DEFINITIONS

- A. Commercial/Industrial-Use Cord Reel: A cord reel subject to severe use in factories, commercial garages, construction sites, and similar locations requiring a harder service-type cord.
- B. UL 1472 Type I Dimmer: Dimmer in which air-gap switch is used to energize preset lighting levels.

1.4 CLOSEOUT SUBMITTALS

A. Sustainable Design Closeout Documentation:

- I. Record floor plan drawings showing as-installed locations of switches and dimmers, indicating lighting zones each device controls, to verify extent of ability of installed Work to provide occupant control for customizing environment.
- II. Record floor plan drawings showing as-installed locations of uncontrolled and marked controlled receptacles superimposed on office furniture layout, to verify extent of ability of installed Work to provide each occupant ability to select at least one uncontrolled receptacle and at least one controlled receptacle for powering workspace equipment. Show locations of UL-approved relocatable power taps and power strips, indicating means of securing for protection from damage and accessibility for inspection. Show locations of temporary extension cords, indicating plan for replacing them with permanent wiring within 90 days.
- III. Submit Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations including all types of wiring devices, plates and engraving.
- IV. Submit Manufacturer's Instructions:
 - a. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
 - b. Include instructions for storage, handling, protection, examination, preparation, operation and installation of product.

1.5 WARRANTY FOR DEVICES

- A. Special Manufacturer Extended Warranty: Manufacturer warrants that devices perform in accordance with specified requirements and agrees to provide repair or replacement of devices that fail to perform as specified within extended warranty period.
 - I. Initial Extended Warranty Period: Five years from date of Substantial Completion; full coverage for labor, materials, and equipment.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

- A. General:
 - 1. Snap switches for general use shall be maintained contact types, and shall be single-pole, double-pole, three-way, or four-way as required for the specific switching arrangements shown on the drawings. They shall be quiet tumbler operation types, having silver alloy contacts, and meeting all NEMA performance standards. Color to match plates unless specifically noted otherwise.
 - 2. Switches shall be toggle or key-operated types, as indicated on the drawings. All key-operated switches shall be keyed alike.
 - 3. Where switches are denoted as having pilot lights, pilot lights shall glow when the switches are "ON". Provide pilot light switch with lamp and miniature step-down transformer. The pilot light shall have a red lens, and the lamp shall be long-life type.
 - 4. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be amber. All units shall be front relampable.
 - 5. Snap switches installed in hazardous locations shall be UL listed for the type of location (class and division).
 - 6. Switches connected to emergency power shall have red lighted handles which shall illuminate when the switches are "Off".
 - 7. Voltage and ampere rating of switches shall be marked on switch, and shall conform to voltage of system to which applied.
 - 8. Switches shall have back and side wired screw pressure terminals.
- B. Description: NEMA WD 1, heavy-duty, AC only general-use snap switch.
- C. Voltage Rating: 120-277 volts, AC.
- D. Current Rating: 20 amperes minimum.
- E. Ratings: Match branch circuit and load characteristics.

2.2 GENERAL-GRADE DUPLEX STRAIGHT-BLADE RECEPTACLES

- A. Duplex Straight-Blade Receptacle:
 - I. Manufacturers: Subject to compliance with requirements. Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
- b. Leviton Manufacturing Co., Inc.
- c. Pass & Seymour; Legrand North America, LLC

II. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- b. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years experience.
- c. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.
 - 1) ANSI/NFPA 70 - National Electrical Code.
 - 2) NEMA WD 1 - General Purpose Wiring Devices.
 - 3) NEMA WD 5 - Wiring Devices, Special Purpose.
 - 4) NEMA WD 6 - Wiring Device Configurations.

III. General Characteristics:

- a. Reference Standards: UL CCN RTRT and UL 498.
- b. All receptacles shall be of standard NEMA configuration, as indicated on the drawings, and shall comply with the respective ANSI C73 series standard for the NEMA configuration. Color to match plates unless specifically noted otherwise.
- c. Duplex receptacles shall have integral UL listed self-grounding clips. Similar, single receptacles shall be provided for plug-in connections of industrial fluorescent light fixtures on the same switching circuit. Receptacle face to be impact resistant nylon.
- d. Weatherproof duplex receptacles shall be provided in all exterior locations, and shall be Ground Fault Circuit Interrupting (GFCI) types, with weatherproof stainless steel cover plates.
- e. Special purpose receptacles for specific equipment shall be grounding types, having the number of poles, voltage and ampere ratings, and NEMA configurations required by the equipment. For each special purpose receptacle, provide an identical mating plug equipped with cord grip, secured to cord.
- f. Duplex receptacles shall have back and side wired screw pressure terminals.
- g. Receptacles to be installed in shower rooms, locker rooms, toilet rooms, janitors' closets, exterior, elevator pit and machine rooms, escalator pits, within six (6) feet of a sink, and other areas as required by NEC, and OSHA Standards shall be ground fault circuit interrupting (GFCI) type, whether specified or not.
- h. Receptacles installed for water coolers shall be GFCI type, or a single receptacle as permitted by NEC.

IV. Options:

- a. Device Color: White, SS#316 at salt corrosive exterior locations.
- b. Configuration:
 - 1) General-duty, NEMA 5-20R.

- 2) General-duty, smooth face, NEMA 5-20R.
- 3) NEMA WD 1; heavy-duty general use receptacle.
- 4) NEMA WD 1; smooth face heavy-duty general use receptacle
- 5) GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

V. Accessories:

- a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
- b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.
- c. Cover plates for exterior receptacles shall be gasketed covers with hinge allowing plug and cord to be plugged in and activated with cover closed.

VI. Extra Materials:

- a. Provide a minimum of two (2) screw drivers of each type of tamper proof screw used on project. Turn over to Owner. Include receipt in O&M manual.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receptacles:

- I. Verify that receptacles to be procured and installed for Owner-furnished equipment are compatible with mating attachment plugs on equipment.

3.2 SELECTION OF CONTROLLED AND UNCONTROLLED RECEPTACLES

A. Private and Open Office Spaces:

- I. Uncontrolled Receptacles at Workstations: Coordinate final locations of receptacles with furniture plan such that at least one uncontrolled receptacle is selected for installation not greater than 6 ft from each workstation.
- II. Contact Architect for resolution of discrepancies between these requirements and Drawings.

3.3 SELECTION OF GFCI RECEPTACLES

- A. Provide non-feed-through GFCI receptacles.

3.4 INSTALLATION OF SWITCHES

- A. Comply with manufacturer's instructions.
- B. Reference Standards:

- C. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
- D. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
- E. Consult Architect for resolution of conflicting requirements.
- F. Install products in accordance with manufacturer's instructions.
- G. Install devices plumb and level.
- H. Install switches with OFF position down.
 - I. In general, lighting control switches shall be located at the lock/strike plate side of door(s). If the drawings indicate otherwise, issue a request for clarification prior to rough-in.
- K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- L. Install receptacles with grounding pole on bottom.
- M. Where 2 or more switches or receptacles are to be installed adjacent to one another, provide a multi-gang coverplate. Provide proper NEC barriers in boxes which serve devices for both the Normal and Emergency Systems or a combined system voltage of 480 volt.
- N. Provide device coverplates for every device installed. Cover plates shall be installed so that they appear straight with no gaps between plate edges and the wall. Maintain vertical and horizontal to within 1/16 of an inch.
- O. In finished areas, provide same type of plate for all surface mounted devices as for recessed mounted devices.
- P. Wiring devices shall not be installed in exposed masonry until cleaning of masonry with acids has been completed.
- Q. All receptacles and switches shall be grounded by means of a ground wire from device ground screw to outlet box screw and branch circuit ground conductor. Strap alone will not constitute an acceptable ground.
- R. All wiring devices, relays, contactors, pushbuttons, selector switches, pilot lights, etc. shall be installed in approved enclosures rated for the appropriate NEMA classified environment.
- S. All devices shall be installed so that only one wire is connected to each terminal.
- T. Once construction is substantially completed, replace all damaged, burned, or scorched wiring devices.
- U. Interfaces with Other Work:
 - I. Coordinate installation of new products with existing conditions.

3.5 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

- A. Comply with manufacturer's instructions.
- B. Reference Standards:
 - I. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
 - II. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
 - III. Receptacle Orientation: Unless otherwise indicated in Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.
 - IV. Consult Architect for resolution of conflicting requirements.
 - V. Inspect each wiring device for defects.
 - VI. Operate each wall switch with circuit energized and verify proper operation.
 - VII. Verify that each receptacle device is energized.
 - VIII. Test each receptacle device for proper polarity.
 - IX. Test each GFCI receptacle device for proper operation.
- C. Interfaces with Other Work:
 - I. Do not install Type 3 SPD, including surge-protected relocatable taps and power strips, on branch circuit downstream of GFCI device.

3.6 FIELD QUALITY CONTROL OF SWITCHES

- A. Field tests and inspections must be witnessed by Architect, Tenant and authorities having jurisdiction.
- B. Tests and Inspections:
 - I. Perform tests and inspections in accordance with manufacturers' instructions.
- C. Nonconforming Work:
 - I. Unit will be considered defective if it does not pass tests and inspections.
 - II. Remove and replace defective units and retest.
- D. Assemble and submit test and inspection reports.
- E. Manufacturer Services:
 - I. Engage factory-authorized service representative to support field tests and inspections.

3.7 FIELD QUALITY CONTROL OF STRAIGHT-BLADE RECEPTACLES

- A. Tests, Examination, and Inspections:
 - I. Insert and remove test plug to verify that device is securely mounted.
 - II. Verify polarity of hot and neutral pins.
 - III. Measure line voltage.

- IV. Measure percent voltage drop.
 - V. Measure grounding circuit continuity: impedance must be not greater than 2 ohms.
 - VI. Perform additional installation and maintenance inspections and diagnostic tests in accordance with NECA NEIS 130 and manufacturers' instructions.
 - VII. Inspect each wiring device for defects.
 - VIII. Operate each wall switch with circuit energized and verify proper operation.
 - IX. Verify that each receptacle device is energized.
 - X. Test each GFCI receptacle device for proper operation.
 - XI. Verify outlet boxes are installed at proper height.
 - XII. Verify wall openings are neatly cut and will be completely covered by wall plates.
 - XIII. Verify floor boxes are adjusted properly.
 - XIV. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- B. Nonconforming Work:
- I. Device will be considered defective if it does not pass tests and inspections.
 - II. Remove and replace defective units and retest.
- C. Assemble and submit test and inspection reports.
- D. Manufacturer Services:
- I. Engage factory-authorized service representative to support field tests and inspections.
- E. Field tests and inspections must be witnessed by Architect, Tenant and authorities having jurisdiction.
- F. Tests and Inspections:
- I. Perform tests and inspections indicated in manufacturer's instructions.
- G. Nonconforming Work:
- I. Components and assemblies will be considered defective if they do not pass tests and inspections.
 - II. Remove and replace defective units and retest.
- H. Assemble and submit test and inspection reports.
- I. Manufacturer Services:
- I. Engage factory-authorized service representative to support field tests and inspections.

3.8 SYSTEM STARTUP FOR SWITCHES

- A. Engage a factory-authorized service representative to perform startup service.
- I. Complete installation and startup checks for momentary switches, dimmer switches, and fan-speed controller switches in accordance with manufacturer's instructions.

3.9 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.10 PROTECTION

A. Devices:

- I. Schedule and sequence installation to minimize risk of contamination of wires and cables, devices, device boxes, outlet boxes, covers, and cover plates by plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other materials.
- II. After installation, protect wires and cables, devices, device boxes, outlet boxes, covers, and cover plates from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

B. Connectors, Cords, and Plugs:

- I. After installation, protect connectors, cords, and plugs from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 26 27 26

SECTION 26 27 26.31
GENERAL-GRADE SINGLE STRAIGHT-BLADE RECEPTACLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single straight-blade receptacles.

1.2 CLOSEOUT SUBMITTALS

A. Warranty documentation.

B. Sustainable Design Closeout Documentation:

1. Record floor plan drawings showing as-installed locations of uncontrolled and marked controlled receptacles superimposed on office furniture layout, to verify extent of ability of installed Work to provide each occupant ability to select at least one uncontrolled receptacle and at least one controlled receptacle for powering workspace equipment. Show locations of UL-approved relocatable power taps and power strips, indicating means of securing for protection from damage and accessibility for inspection. Show locations of temporary extension cords, indicating plan for replacing them with permanent wiring within 90 days.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Items: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Special Tools: Proprietary equipment and software required to maintain, repair, adjust, or implement future changes to controlled receptacles.

1.4 WARRANTY

A. Special Manufacturer Extended Warranty: Manufacturer warrants that devices perform in accordance with specified requirements and agrees to provide repair or replacement of devices that fail to perform as specified within extended warranty period.

1. Extended Warranty Period: Five years from date of Substantial Completion; full prorated coverage for labor, materials, and equipment.
2. Follow-On Extended Warranty Period: Eight years from date of Substantial Completion; full prorated coverage for materials that failed because of transient voltage surges only, free on-board origin destination, freight prepaid.

PART 2 - PRODUCTS

2.1 SINGLE STRAIGHT-BLADE RECEPTACLES

- A. Description: General-grade Single receptacles for use in wiring systems recognized by NFPA 70.
- B. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
 - 2. General Characteristics:
 - a. Reference Standards:
 - 1) UL CCN RTRT and UL 498.
 - 2) Surge Protective Devices: UL 1449, Type 3.
- C. Single Straight-Blade Receptacle:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour; Legrand North America, LLC
 - 2. Options:
 - a. Device Color: As selected by the Architect and/or indicated on architectural Drawings.
 - b. Configuration:
 - 1) General-duty, NEMA 5-20R.
 - 2) General-duty, smooth face, NEMA 5-20R
 - 3) General-duty, NEMA 6-15R NEMA 6-20R.
 - 4) General-duty, smooth face, NEMA 6-15R NEMA 6-20R.
 - 3. Accessories:
 - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
 - b. Securing Screws for Cover Plate: Metal with head color matching wall plate finish.

- D. Weather-Resistant Single Straight-Blade Receptacle:
1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour, Legrand North America, LLC
 2. Options:
 - a. Device Color: As selected by the Architect and/or indicated on architectural Drawings.
 - b. Configuration:
 - 1) General-duty, NEMA 5-20R.
 - 2) Heavy-duty, NEMA 5-20R.
 - 3) Heavy-duty, smooth face, NEMA 5-20R.
 3. Accessories:
 - a. Cover Plate: Stainless steel #316.
 - b. Securing Screws for Cover Plate: Stainless Steel to match plate finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that receptacles to be procured and installed for Owner-furnished equipment are compatible with mating attachment plugs on equipment.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions.
- B. Reference Standards:
1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
 2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
 3. Receptacle Orientation: Unless otherwise indicated in Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.
 4. Consult Architect for resolution of conflicting requirements.
- C. Identification:

1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 260553 "Identification for Electrical Systems."
 - a. Mark cover or cover plate using hot, stamped, or engraved machine printing with black white red-filled lettering, and provide durable wire markers or tags inside device box or outlet box.
 - b. Healthcare Facilities: Distinctively identify covers or cover plates of device boxes and outlet boxes that are supplied from life safety and critical branch power supplies following facility's standard practice.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation
- B. Field tests and inspections must be witnessed by Architect Tenant authorities having jurisdiction.
- C. Tests and Inspections:
 1. Insert and remove test plug to verify that device is securely mounted.
 2. Verify polarity of hot and neutral pins.
 3. Measure line voltage.
 4. Measure percent voltage drop.
 5. Measure grounding circuit continuity: impedance must be not greater than 2 ohms.
 6. Healthcare Facilities: Test straight-blade receptacles in patient care spaces with receptacle pin tension test instrument in accordance with NFPA 99. Retention force of ground pin must be not less than 115 g (4 oz).
 7. Perform additional installation and maintenance inspections and diagnostic tests in accordance with NECA NEIS 130 and manufacturers' instructions.
- D. Nonconforming Work:
 1. Device will be considered defective if it does not pass tests and inspections.
 2. Remove and replace defective units and retest.

3.4 PROTECTION

- A. Schedule and sequence installation to minimize risk of contamination of wires and cables, devices, device boxes, outlet boxes, covers, and cover plates by plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other materials.
- B. After installation, protect wires and cables, devices, device boxes, outlet boxes, covers, and cover plates from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 26 27 26.31

SECTION 26 27 26.33
GENERAL-GRADE DUPLEX STRAIGHT-BLADE RECEPTACLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Duplex straight-blade receptacles.

1.2 CLOSEOUT SUBMITTALS

A. Warranty documentation.

B. Sustainable Design Closeout Documentation:

1. Record floor plan drawings showing as-installed locations of uncontrolled and marked controlled receptacles superimposed on office furniture layout, to verify extent of ability of installed Work to provide each occupant ability to select at least one uncontrolled receptacle and at least one controlled receptacle for powering workspace equipment. Show locations of UL-approved relocatable power taps and power strips, indicating means of securing for protection from damage and accessibility for inspection. Show locations of temporary extension cords, indicating plan for replacing them with permanent wiring within 90 days.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Items: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Special Tools: Proprietary equipment and software required to maintain, repair, adjust, or implement future changes to controlled receptacles.

1.4 WARRANTY

A. Special Manufacturer Extended Warranty: Manufacturer warrants that devices perform in accordance with specified requirements and agrees to provide repair or replacement of devices that fail to perform as specified within extended warranty period.

1. Extended Warranty Period: Five years from date of Substantial Completion; full prorated coverage for labor, materials, and equipment.
2. Follow-On Extended Warranty Period: Eight years from date of Substantial Completion; full prorated coverage for materials that failed because of transient voltage surges only, free on-board origin destination, freight prepaid.

PART 2 - PRODUCTS

2.1 DUPLEX STRAIGHT-BLADE RECEPTACLES

- A. Description: General-grade duplex receptacles for use in wiring systems recognized by NFPA 70.
- B. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
 - 2. General Characteristics:
 - a. Reference Standards:
 - 1) UL CCN RTRT and UL 498.
 - 2) Surge Protective Devices: UL 1449, Type 3.
- C. Duplex Straight-Blade Receptacle:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour, Legrand North America, LLC
 - 2. Options:
 - a. Device Color: As selected by the Architect and/or indicated on architectural Drawings.
 - b. Configuration:
 - 1) General-duty, NEMA 5-20R.
 - 2) General-duty, smooth face, NEMA 5-20R
 - 3) General-duty, NEMA 6-15R NEMA 6-20R.
 - 4) General-duty, smooth face, NEMA 6-15R NEMA 6-20R.
 - 3. Accessories:
 - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
 - b. Securing Screws for Cover Plate: Metal with head color matching wall plate finish.

D. Weather-Resistant Duplex Straight-Blade Receptacle:

1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector
 - b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour, Legrand North America, LLC

2. Options:
 - a. Device Color: As selected by the Architect and/or indicated on architectural Drawings.
 - b. Configuration:
 - 1) General-duty, NEMA 5-20R.
 - 2) Heavy-duty, NEMA 5-20R.
 - 3) Heavy-duty, smooth face, NEMA 5-20R.

3. Accessories:
 - a. Cover Plate: Stainless steel #316.
 - b. Securing Screws for Cover Plate: Stainless Steel to match plate finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that receptacles to be procured and installed for Owner-furnished equipment are compatible with mating attachment plugs on equipment.

3.2 SELECTION OF CONTROLLED AND UNCONTROLLED RECEPTACLES

- A. Private and Open Office Spaces:
 1. Uncontrolled Receptacles at Workstations: Coordinate final locations of receptacles with furniture plan such that at least one uncontrolled receptacle is selected for installation not greater than 6 ft from each workstation.
 2. Contact Architect for resolution of discrepancies between these requirements and Drawings.

3.3 INSTALLATION

- A. Comply with manufacturer's instructions.
- B. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
3. Receptacle Orientation: Unless otherwise indicated in Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.
4. Consult Architect for resolution of conflicting requirements.

C. Identification:

1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 26 05 53 "Identification for Electrical Systems."
 - a. Mark cover or cover plate using hot, stamped, or engraved machine printing with black white red-filled lettering, and provide durable wire markers or tags inside device box or outlet box.
 - b. Healthcare Facilities: Distinctively identify covers or cover plates of device boxes and outlet boxes that are supplied from life safety and critical branch power supplies following facility's standard practice.

D. Interfaces with Other Work:

1. Do not install Type 3 SPD, including surge-protected relocatable taps and power strips, on branch circuit downstream of GFCI device.

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

- B. Field tests and inspections must be witnessed by Architect Tenant authorities having jurisdiction.

C. Tests and Inspections:

1. Insert and remove test plug to verify that device is securely mounted.
2. Verify polarity of hot and neutral pins.
3. Measure line voltage.
4. Measure percent voltage drop.
5. Measure grounding circuit continuity: impedance must be not greater than 2 ohms.
6. Healthcare Facilities: Test straight-blade receptacles in patient care spaces with receptacle pin tension test instrument in accordance with NFPA 99. Retention force of ground pin must be not less than 115 g (4 oz).
7. Perform additional installation and maintenance inspections and diagnostic tests in accordance with NECA NEIS 130 and manufacturers' instructions.

D. Nonconforming Work:

1. Device will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

3.5 PROTECTION

- A. Schedule and sequence installation to minimize risk of contamination of wires and cables, devices, device boxes, outlet boxes, covers, and cover plates by plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other materials.
- B. After installation, protect wires and cables, devices, device boxes, outlet boxes, covers, and cover plates from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 26 27 26.33

SECTION 26 43 13
SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type 3, Type 4, and Type 5 surge protective devices (SPDs).
2. Enclosures.
3. Conductors and cables.

1.2 DEFINITIONS

- A. In: Nominal discharge current.
- B. Maximum Continuous Operating Voltage (MCOV): The maximum designated RMS value of the power frequency voltage that may be continuously applied to the mode of protection of an SPD.
- C. Metal-Oxide Varistor (MOV): An electronic component with a significant bidirectional, nonlinear current-voltage characteristic.
- D. Mode(s), Modes of Protection, or Protection Modes: Electrical paths where the SPD offers defense against transient over voltages. Examples include: line to neutral (L-N), line to ground (L-G), line to line (L-L), and neutral to ground (N-G).
- E. SCCR: Short-circuit current rating.
- F. Type 1 SPDs: Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service disconnect overcurrent device.
- G. Type 2 SPDs: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.
- H. Type 3 SPDs: Point of utilization SPDs.
- I. Type 4 SPDs: Component SPDs, including discrete components, as well as assemblies.
- J. Type 5 SPDs: Discrete component surge suppressors, such as MOVs that may be mounted on a printed wiring board, connected by its leads or provided within an enclosure with mounting means and wiring terminations.
- K. Voltage Protection Rating (VPR): A rating selected from UL 1449 list of preferred values assigned to each mode of protection.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

- a. Include electrical characteristics, specialties, and accessories for SPDs.
- b. Certification of compliance with UL 1449 by qualified electrical testing laboratory recognized by authorities having jurisdiction including the following information:
 - 1) Tested values for VPRs.
 - 2) In ratings.
 - 3) MCOV, type designations.
 - 4) OCPD requirements.
 - 5) Manufacturer's model number.
 - 6) System voltage.
 - 7) Modes of protection.

B. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

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

1.5 WARRANTY

A. Special Manufacturer Extended Warranty: Manufacturer warrants that SPDs perform in accordance with specified requirements and agrees to provide repair or replacement of SPDs that fail to perform as specified within extended warranty period.

- 1. Initial Extended Warranty Period: Five, 10 year(s) from date of Substantial Completion, for labor, materials, and equipment.

PART 2 - PRODUCTS

2.1 TYPE 3, TYPE 4, AND TYPE 5 SURGE PROTECTIVE DEVICES (SPDs)

- A. Type 3, Type 4, and Type 5 SPDs are not approved for field installation. See "Related Requirements" Paragraph in "Summary" Article for products with manufacturer-installed Type 3, Type 4, and Type 5 SPDs.

2.2 ENCLOSURES

- A. Indoor Enclosures: Type 1.
- B. Outdoor Enclosures: Type 3R Type 4X.

2.3 CONDUCTORS AND CABLES

- A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide OCPD and disconnect for installation of SPD in accordance with UL 1449 and manufacturer's instructions.
- B. Install leads between disconnects and SPDs short, straight, twisted, and in accordance with manufacturer's instructions. Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
 - 1. Do not splice and extend SPD leads unless specifically permitted by manufacturer.
 - 2. Do not exceed manufacturer's recommended lead length.
 - 3. Do not bond neutral and ground.
- C. Use crimped connectors and splices only. Wire nuts are unacceptable.

3.2 FIELD QUALITY CONTROL

- A. Field tests and inspections must be witnessed by Architect Tenant authorities having jurisdiction.
- B. Tests and Inspections:
 - 1. Compare equipment nameplate data for compliance with Drawings and the Specifications.
 - 2. Inspect anchorage, alignment, grounding, and clearances.
 - 3. Verify that electrical wiring installation complies with manufacturer's installation requirements.
- C. Nonconforming Work:
 - 1. SPDs that do not pass tests and inspections will be considered defective.
 - 2. Remove and replace defective units and retest.
- D. Prepare test and inspection reports.
- E. Manufacturer Services:
 - 1. Engage factory-authorized service representative to support supervise field tests and inspections.

3.3 STARTUP SERVICE

- A. Complete startup checks in accordance with manufacturer's instructions.

- B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests; reconnect them immediately after the testing is over.
- C. Energize SPDs after power system has been energized, stabilized, and tested.

END OF SECTION 26 43 13

SECTION 26 50 00
LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. LED Luminaires are described in contract documents (drawings)
2. Luminaire fittings.
3. Lamps.

1.2 DEFINITIONS

- A. BUG Rating: Backlight, uplight, and glare rating for light pollution from exterior luminaires.
- B. Correlated Color Temperature (CCT): The absolute temperature (in kelvins) of a blackbody whose chromaticity (color quality) most nearly resembles that of the light source.
- C. Color Rendering Index (CRI): The measure of the degree of color shift objects undergoes when illuminated by the light source as compared with the color of those same objects when illuminated by a reference light source. The lower the CRI of a light source, the more difficult it is to identify colors and stripes on electronic components and wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturers' published instructions.
- B. Field Reports:
 1. Manufacturer's field reports for field quality-control support.
 2. Manufacturer's field reports for system startup support.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Spare parts.
- B. Extra stock material.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect exposed surface finishes on lighting equipment by applying strippable, temporary protective covering before shipping.

1.6 WARRANTY FOR LUMINAIRES

- A. Special Installer Extended Warranty: Installer warrants that fabricated and installed luminaires perform in accordance with specified requirements and agrees to repair or replace products that fail to perform as specified within extended-warranty period. Warranty must convey to Owner upon acceptance of the Work.
 - 1. Extended-Warranty Period: 5 years from date of Substantial Completion; full coverage for labor, materials, and equipment.
- B. Special Manufacturer Extended Warranty: Manufacturer warrants that luminaires perform in accordance with specified requirements and agrees to provide repair or replacement of products that fail to perform as specified within extended-warranty period.

PART 2 - PRODUCTS

2.1 LUMINAIRES

- A. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
 - b. See individual product types below for listing criteria.
 - c. Marked in accordance with UL CCN HYXT, including UL 1598, for compatible power supply, installation location, and environmental conditions.
- B. Source Quality Control:
 - 1. Compile and submit product data.
 - 2. Compile and submit sustainable design product data.
 - 3. Compile and submit samples.

2.2 LUMINAIRE FITTINGS

- A. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
 - b. See individual product types below for listing criteria.
- B. Source Quality Control:
 - 1. Compile and submit product data.
 - 2. Compile and submit sustainable design product data.
 - 3. Compile and submit samples.

C. Luminaire Support Accessories:

1. Product Characteristics:

- a. Sized and rated for luminaire weight.
- b. Capable of maintaining luminaire position after cleaning and relamping.
- c. Capable of supporting luminaire without causing deflection of ceiling or wall.
- d. Capable of supporting horizontal force equal to 100 percent of luminaire weight and vertical force equal to 400 percent of luminaire weight.

2. Required Product Options:

- a. Hook Hangers: Integrated assembly matched to luminaire, supply voltage, and equipment with threaded attachment, cord, and locking-type plug.
- b. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage wire supports adjustable to 10 ft in length.
- c. Aircraft Cables: 5/32-inch diameter aircraft cable supports adjustable to 10 ft in length.
- d. Single-Stem Hangers: 1/2-inch nominal diameter steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- e. Rod Hangers: 3/16-inch nominal diameter, cadmium-plated, threaded steel rod.

D. LED Lamp

1. Dimmable from 100 percent to zero percent of maximum light output.

2. LED Lamp Shape and Optics:

- a. LED lamps, nominal length of 48-inch, 2800 lm (initial minimum), CRI 75 (minimum), CCT 3500 K, and average rated life of 20,000 hours unless otherwise indicated.
- b. LED lamps, nominal length of 24-inch, 1300 lm (initial minimum), CRI 75 (minimum), CCT 3500 K, and average rated life of 20,000 hours unless otherwise indicated.
- c. LED lamps, nominal length of 45.2-inch, 2900 lm (initial minimum), CRI 85 (minimum), CCT 3000 K, and average rated life of 20,000 hours unless otherwise indicated.
- d. LED lamps, nominal length of 45.2-inch, 5000 lm (initial minimum), CRI 85 (minimum), CCT 4100 K, and average rated life of 20,000 hours unless otherwise indicated.
- e. LED Lamps: Four-pin, CRI 80 (minimum), CCT 3500 K, average rated life of 10,000 hours at three hours of operation per start, and suitable for use with dimming ballasts unless otherwise indicated.
 - 1) CF13 PL-T: 13 W, plug-in T4 triple tube, 900 lm (initial minimum).
 - 2) CF18 PL-T: 18 W, plug-in T4 triple tube, 1200 lm (initial minimum).
 - 3) CF26 PL-T: 26 W, plug-in T4 triple tube, 1800 lm (initial minimum).
 - 4) CF32 PL-T: 32 W, plug-in T4 triple tube, 2400 lm (initial minimum).
 - 5) CF42 PL-T: 42 W, plug-in T4 triple tube, 3200 lm (initial minimum).

f. CRI: 80+ 90+.

3. Required Product Options:

- a. CCT: 3000 K 4200 K <Insert kelvins>.

- b. UV control.
- c. UVC germicidal spectrum.

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 roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Shop Drawings: Prepare and submit the following:
 - 1. Drawings, Diagrams, and Supporting Documents for Custom Luminaires:
 - a. Include plans, elevations, sections, and mounting and attachment details.
 - b. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - c. Include diagrams for power, signal, and control wiring.
- B. Temporary Lighting: If approved by Architect, specified luminaires for Project may be installed for temporary lighting. Install and energize minimum quantity of luminaires necessary to meet needs of construction activities. When construction is sufficiently complete, remove, disassemble, clean, and relamp luminaires used for temporary lighting before reinstalling for Project delivery.

3.3 SELECTION OF LIGHTING

- A. Finished Spaces:
 - 1. Location: <Insert list of product types>.
- B. Unfinished Spaces:
 - 1. Location: <Insert list of product types>.

3.4 INSTALLATION OF LIGHTING

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are

specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Installation of Indoor Lighting Systems: NECA NEIS 500.
2. Installation of Exterior Lighting Systems: NECA NEIS 501.
3. Installation of Industrial Lighting Systems: NECA NEIS 502.
4. Installation of Luminaires, Lampholders, and Lamps: Article 410 of NFPA 70.
5. Installation of Extra-Low-Voltage Lighting: Article 411 of NFPA 70.
6. Installation of Lighting for Sensitive Electronic Equipment: Article 647 of NFPA 70.
7. Installation of Emergency Lighting and Exit Signs: ICC IBC, NFPA 101, and Parts IV and V in Article 700 of NFPA 70.
8. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Install luminaires level, plumb, and square with finished floor or grade unless otherwise indicated.
2. Install luminaires at height and aiming angle as indicated on Drawings.
3. Coordinate layout and installation of luminaires with other construction.
4. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
5. Exterior Bollard Luminaires:
 - a. Align units for optimum directional alignment of light distribution.
 - b. Install on concrete base with top 4 inch above finished grade or surface at luminaire location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."
6. Exterior In-Ground Luminaires:
 - a. Install on concrete base with top 4 inch above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."
7. Exterior Corrosion Prevention:
 - a. Do not use aluminum in contact with earth or concrete. When in direct contact with dissimilar metals, protect aluminum with insulating fittings or treatment.
 - b. When embedding steel conduits in concrete, wrap conduit with 10 mil thick, pipe-wrapping plastic tape applied with a 50 percent overlap.
8. Flush-Mounted Luminaire Support:
 - a. Secured to outlet box.
 - b. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - c. Trim ring flush with finished surface.
9. Wall-Mounted Luminaire Support:

- a. Attached to structural members in walls. Attached to a minimum 1/8 inch backing plate attached to wall structural members. Attached using through bolts and backing plates on either side of wall.
 - b. Do not attach luminaires directly to gypsum board.
10. Suspended Luminaire Support:
- a. Ceiling Mount:
 - 1) Hook hangers.
 - 2) Two wires.
 - 3) Two Four aircraft cables.
 - b. Pendants and Rods: Where longer than 48-inch, brace to limit swinging.
 - c. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - d. Continuous Rows of Luminaires: Provide tubing or stem for wiring at one point and tubing or rod wire support for suspension for each unit length of luminaire chassis, including one at each end.
 - e. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
11. Ceiling-Grid-Mounted Luminaire Support:
- a. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each luminaire. Locate not more than 6 inches from luminaire corners.
 - b. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for application.
 - c. Luminaires of Sizes Smaller Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with no fewer than two 3/4-inch metal channels spanning and secured to ceiling tees.
 - d. Seismic Restraint: Install at least one independent support rod or wire from structure to tab on luminaire. Wire or rod must have breaking strength for luminaire weight with safety factor of 3.
12. Remote Mounting of Ballasts: Do not exceed distance between ballast and luminaire recommended by ballast manufacturer.
13. Emergency Power Units: Secure with approved fasteners in four or more locations, spaced near corners of unit.
14. Install wiring connections for luminaires.
15. Identification: Provide labels for luminaires and associated electrical equipment.
- a. Identify field-installed conductors, interconnecting wiring, and components.
 - b. Provide warning signs.
 - c. Label each enclosure with engraved metal or laminated-plastic nameplate.
- D. Systems Integration: Integrate lighting control devices and equipment with electrical power connections for operation of luminaires as specified.

3.5 FIELD QUALITY CONTROL OF LIGHTING

- A. Acceptance Testing Preparation:
- B. Field tests and inspections must be witnessed by Architect Tenant authorities having jurisdiction.
- C. Tests and Inspections:
 - 1. Perform manufacturer's recommended tests and inspections.
 - 2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 3. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
 - 4. Verify operation of photoelectric controls.
 - 5. Exterior Illumination Tests:
 - a. Measure light intensities at night. Use photometers with calibration referenced to NIST standards.
- D. Nonconforming Work:
 - 1. Luminaire will be considered defective if it does not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- E. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.
- F. Manufacturer Services: Engage factory-authorized service representative to support supervise field tests and inspections.
 - 1. Manufacturer's Field Reports for Field Quality-Control Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at Project site.

3.6 SYSTEM STARTUP

- A. Perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's published instructions.
 - 2. Burn-in lamps that require specific aging period to operate properly, prior to occupancy by Owner.
 - 3. Charge emergency power units and batteries minimum of one hour and depress switch to conduct short-duration test.
 - 4. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.
- B. Manufacturer Services: Engage factory-authorized service representative to support supervise system startup.
 - 1. Manufacturer's Field Reports for System Startup Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at Project site.

3.7 ADJUSTING

- A. Luminaire Aiming Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aiming direction of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 2. Parts and supplies must be manufacturer's authorized replacement parts and supplies.
 3. Adjust aim of luminaires in presence of Architect.

3.8 CLOSEOUT ACTIVITIES

- A. Maintenance Material Submittals:
1. Spare Parts: Furnish to Owner spare parts, for repairing lighting equipment, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:
 - a. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - b. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.
 2. Extra Stock Material: Furnish to Owner extra material, from same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Include the following:
 - a. Luminaire-Mounted Emergency Battery Packs: 1 for every 20, 1 for every 50 of each type and rating installed. Furnish at least one of each type.

3.9 PROTECTION

- A. After installation, protect lighting equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 26 50 00