2. Color pigment shall conform to ASTM C 979.

3. Integral colored pigment shall be integrally-mixed, alkali-stable, lightfast, weather and UV resistant pigment.

4. Color shall be maintained uniformly throughout the WORK as represented by accepted field sample mock-up wall panel erected at the Site.

2.3 INTEGRAL WATER REPELLENT ADMIXTURE (BLOCK, CAPS, SILLS)

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal.

a. Master Builders Inc., a Division of BASF; Rheopel XD Admixture.

B. Description: Integral water repellent shall be a liquid polymeric admixture resistant to water penetration with a Class E rating in accordance with ASTM E 514.

2.4 MASONRY VENEER MORTAR

A. Description:

1. Mortar for masonry veneer units shall be Type S Portland cement – lime mortar conforming to the property specification requirements of ASTM C 270.

a. Portland cement shall conform to ASTM C 150 Type I or Type II. Masonry cements, mortar cements, and plastic cement shall NOT be used.

1) White Portland cement shall contain a maximum of 0.03 percent water-soluble alkali when tested in accordance with ASTM C 114.

b. Lime for masonry mortar shall be hydrated lime conforming to ASTM C 207, Type S.

2. Aggregates:

a. Sand shall be clean, durable particles, free from injurious amounts of organic matter, dust, lumps, shale, alkali, or surface coatings.

1) Sand for mortar shall conform to ASTM C 144.

3. Water shall be from a potable water supply. Water shall be free from deleterious amounts of oils, acids, alkalis, or organic matter, and shall be clean and fresh.

4. Mortar Admixtures:

a. Mortar admixtures shall not be used unless indicated herein.

1) Antifreeze liquids, chloride salts, or other such substances shall NOT be used in mortar.

2) Air entraining substances shall NOT be used in mortar.

b. Mortar shall have integral colored pigment, as indicated herein, added during mixing in accordance with Manufacturer's written instructions.

c. Mortar shall have integral water repellent, as indicated herein, added during mixing in accordance with Manufacturer's written instructions.

d. Mortar admixtures shall be non-staining and shall not contain fillers, adulterants, or additives that will negatively affect the characteristics or performance of the masonry veneer, or mortar mix design.

e. Amount of admixtures used shall be as recommended in writing by the Manufacturer.

2.5 INTEGRAL COLOR PIGMENT ADMIXTURE (MORTAR)

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal.

a. Davis Colors, TrueTone Colors.

B. Description:

1. Integral color pigments for mortar shall be pure iron oxide concentrated color pigments.

a. Colors shall be selected and approved by the OWNER from Manufacturer's full color range including custom colors, and may be required to exactly match other building components, as determined by the OWNER.

1) Tentative color selection: To Be Selected.

2) The OWNER reserves the option of changing this tentative color selection during the submittal process.

2.6 INTEGRAL WATER REPELLENT ADMIXTURE (MORTAR)

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal.

a. Master Builders Inc., a Division of BASF, Rheopel Mortar Admixture.

B. Description: Integral water repellent shall be a liquid polymeric admixture resistant to water penetration with a Class E rating in accordance with ASTM E 514.

2.7 MASONRY CLEANER

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal.

a. Prosoco, Inc., Enviro Klean Saftey Klean, Masonry Cleaner.

B. Description: A detergent masonry cleaner as recommended in writing by the masonry veneer Manufacturer.

2.8 JOINT REINFORCEMENT, ANCHORS, TIES, AND STRAPS

A. Joint Reinforcement: Joint reinforcement shall conform to the requirements of ACI/ASCE 530 and the CODE, and shall be prefabricated in straight lengths of not less than 10-feet (3.05 m) with matching corner and tee units. Units shall conform to ASTM A 951 and shall be ASTM A 153 Hot Dipped Galvanized.

1. Joint reinforcement shall be welded wire units fabricated from cold-drawn steel wire with deformed continuous side rods and plain cross rods, crimped for cavity wall construction, and having a width of approximately 2-inches (50.8 mm) less than the nominal thickness of wall or partition.

a. Adjustable Masonry Veneer Ties, Hot Dipped Galvanized:

1) Manufacturer and Product or equal: Hohman & Barnard, Inc., No. 280 S.I.S; Wire-Bond, Series 600 Ladder with WIRE-BOND Clip, or equal.

2) Description: 9-gauge ladder type with adjustable ties having seismic clips and continuous 9-gauge wire to secure and reinforce the masonry veneer.

B. Anchors:

1. Dovetail slots shall be Heckmann Building Products, Dovetail Slot No. 100, or equal.

a. Dovetail slots shall be provided for masonry veneer anchorage to concrete framework, walls, and ceilings.

b. Dovetail slots shall be fabricated from 20-gauge, ASTM A 153 , class B, hot dipped galvanized steel and shall be furnished with polystyrene fillers. Sizes shall be coordinated with the anchors used.

2. Dovetail anchors shall be Heckmann Building Products; Dovetail Triangular Anchors No. 103, or equal.

a. Provide 12-gauge dovetail clip attached to 3/16-inch (4.8 mm) diameter triangular tie, length as required, hot dipped galvanized steel ties manufactured for use with the anchor slots provided.

3. Dovetail seismic anchors shall be Heckmann Building Products; Dovetail Seismic Anchor No. 361, or equal.

4. Weld-On Adjustable Anchors and Ties shall be Heckmann Building Products, Anchors No. 315, Triangular ties No. 316, or equal.

    a. Weld on adjustable anchors and ties shall be 1/4-inch (6.4 mm) diameter hot dipped galvanized steel.

C. Straps shall be Heckmann Building Products; No. 273, or equal.

1. Masonry straps shall be minimum 1/4-inch (6.4-mm) thick by 1-inch (25 mm) wide, and of the required length, fabricated from hot dipped galvanized steel.

2.9 MISCELLANEOUS ATTACHMENT DEVICES

A. Provide miscellaneous reinforcement, ties, anchors, fasteners, straps, and other attachment devices required both for the anchorage of WORK of this Section and for that of other trades requiring attachment to masonry veneer which are not specifically provided under separate Sections.

B. Miscellaneous attachment devices shall be hot dipped galvanized steel and shall comply with ACI/ASCE 530 and the CODE.

2.10 MASONRY ACCESSORIES

A. Through wall flashing shall be **Hohmann and Barnard, Inc., Flashing**, or equal.

1. Through wall flashing shall be type 304 stainless steel, 26 gauge.

B. Cavity wall mesh shall be **Mortar Net USA, Ltd, The Mortar Net**, or equal.

1. Mortar dropping collection device (mesh) shall be high-density polyethylene, 2- inches (50.8 mm) thick by 10-inches high (254 mm), 90 percent open fibrous recycled polyester or high-density polyethylene mesh construction. Cavity wall mesh shall be constructed in a dovetail shape to prevent mortar from forming a continuous dam.

C. Weepholes shall be Wire-Bond, Clear Rectangular Vent, or equal.

1. Weepholes shall be made of clear butyrate and shall be 3/8-inch (9.5 mm) wide by 1 1/2-inches (38.1 mm) deep by 3 1/2-inches (88.9 mm) high.

D. Compressible Filler shall be Sandell Manufacturing Company; Polytite Filler, or equal.

1. Foamed polyurethane strip saturated with polybutylene waterproofing material. When compressed to 50 percent of its original volume, filler shall hold a head of 6-feet (1.83 m) of water, and maintain its resiliency to allow for installation in temperatures as low as 40 deg F (4.4 deg C). Filler shall remain waterproof at 50 percent compression between temperatures of minus 40 deg F (4.4 deg C) and 200 deg F (93.3 deg C). Elongation shall be at least 325 percent with a tensile strength of not less than 53 psi (.37 MPa). The polybutylene compound shall not migrate in the polyurethane strip.

E. Control Joint Material shall be **Dur-O-Wal**, or equal.

1. Control joint material shall be factory-extruded preformed rubber shear keys conforming to ASTM D 2000, 2AA-805.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

1. Materials shall be protected and stacked off the ground on the Site. Materials shall be protected from the weather and staining with the use of tarpaulins or other covering.

C. Handle materials in strict accordance with Manufacturer's written instructions.

D. Masonry units shall be particularly well-covered and protected during manufacture, storage, shipping, and while on the Site to prevent contamination that may lead to efflorescence in the finished WORK.

1. If efflorescence or staining occurs, the ENGINEER may request the removal and replacement of areas so affected.

3.2 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after installation.

B. Protect surrounding WORK from damage that may result from operations under this Section.

C. Masonry construction in cold and hot weather shall conform to the applicable requirements of the CODE unless more stringent requirements are indicated herein.

1. Cold Weather Construction: When the ambient temperature or the temperature of masonry units falls below 40 deg F (4.4 deg C), conform to procedures set by the CODE for cold weather construction. Provide cold weather heating and protection for both mortar and grout.

a. Heat and enclosures will be the only protection method allowed for cold weather construction. Mortar additives shall NOT be used for this purpose.

2. Hot Weather Construction: Where the ambient temperature exceeds 100 deg F (37.8 deg C) or 90 deg F (32.2 deg C) with a wind velocity greater than 8 mph (12.8 kph), conform to procedures set by the CODE for hot weather construction.

3.3 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

2. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units shall be rejected.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where masonry veneer will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed masonry veneer.

a. Provide inserts, backing, blocking, anchoring devices, and reinforcements that must be built into other WORK for the installation of masonry veneer. Coordinate delivery with other WORK to avoid delay.

b. Before beginning masonry WORK, verify that tolerances of supporting members are within allowable limits, and that any required reinforcing and supports have been placed in accordance with the requirements of the Contract Documents.

c. Bearing surface for masonry shall be such that the thickness of the initial bed joint shall be not less than 1/4-inch (6.35 mm) nor more than 3/4-inch (19 mm) in thickness.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate CONTRACTOR's acceptance of the substrate, areas, and conditions.

D. Refer to Section 04 22 00 – Reinforced Concrete Block Masonry, for Special Inspection requirements which also apply to this Section.

3.4 PREPARATION

A. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

B. Before laying masonry, remove laitance, loose aggregate, or anything else that would interfere with bond between the mortar and substrate.

3.5 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with applicable references, with the requirements of the CODE, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the ENGINEER.

B. The CONTRACTOR shall provide necessary fasteners, anchors, and shims required for a complete installation, and shall be secure, plumb, and true to line, allowing for required movement, including expansion and contraction.

C. The CONTRACTOR shall provide corrosion resistant fasteners, anchors, and shims required for a complete installation, and shall be secure, plumb, and true to line, allowing for required movement, including expansion and contraction.

D. The CONTRACTOR shall provide separation of dissimilar materials to ensure no galvanic action occurs.

E. Horizontal lines shall be level, and vertical lines shall be plumb. Anchors for guides, brackets, and other fasteners shall be provided as shown on the Shop Drawings.

F. Do not wet concrete masonry veneer units before laying.

G. Mixing and Handling:

1. Mortar Mixing:

a. Accurately measure ingredients according to the proportions indicated for the batch and mix in a mechanically-operated batch mixer.

b. Mix mortar in accordance with the requirements of the CODE, using a mechanically-operated mixer in which the quantity of water added can be accurately and uniformly controlled. Accurately measure mortar constituents by volume.

c. The consistency of the mortar shall be adjusted to the satisfaction of the mason with water added as necessary to produce a workable mix. Mortar may be re-tempered by adding water as frequently as needed to restore the required consistency. When water is added, it shall be mixed into the mortar, not splashed over the surface.

d. Mortar that has begun to "set" or that has not been used within 2-1/2 hours after initial mixing water was added to the dry ingredients shall be discarded.

e. Where the dry-mix method is employed, the materials for each patch shall be well turned over together until the even color of the mixed, dry materials indicates that the cementitious material has been thoroughly distributed throughout the mass, after which the water shall be gradually added until a thoroughly mixed mortar of the required plasticity is obtained.

H. Masonry units shall be laid in bonding pattern as indicated unless otherwise indicated. Tool joints dense and neat. Placing of mortar and units shall conform to the CODE.

1. Where soldier courses or arches are indicated, maintain precise alignment and equal spacing of joints.

2. Unless otherwise indicated, corners and intersections of masonry veneer walls shall be bonded in each course with a true masonry bond, except that when necessarily erected separately, they shall be anchored with rigid steel anchors spaced not more than 2-feet (.61 m) apart vertically.

I. Sizes shall be as required by the Contract Documents. Where “soaps” and “splits” are used, the space between these members and the backup material shall be slushed full of mortar.

J. Joints of masonry shall be tooled in accordance with the following:

1. Wait until unit mortar is thumbprint hard before tooling joint.

2. The required labor personnel shall be kept on the job after hours, if necessary, to properly tool joints.

3. Vertical, horizontal, and arched joints shall maintain uniform in spacing.

4. Joints for masonry veneer units shall be 3/8-inch (9.5 mm) and concave, unless otherwise indicated.

K. Control joints shall be installed at the intersection of masonry walls with structural concrete and elsewhere as indicated. The maximum length, horizontally, between vertical control joints shall be 24-feet (7.3 m), however joints shall be located only as shown or approved in writing by the ENGINEER.

1. Do not start masonry wall construction until locations of control joints are approved by the ENGINEER.

2. Control joints shall be 3/8 inch (9.5 mm), equal in width to the standard mortar joint.

3. Discontinue joint reinforcement at control joints and at expansion joints, unless otherwise indicated.

L. Joint reinforcement shall be installed continuously, interrupted only at control joints and at expansion joints, and shall be placed in every other course or 16-inches (406 mm) on center vertically, whichever is less, unless otherwise indicated.

M. Masonry slots, chases, or openings required for the proper installation of the WORK of other Sections shall be constructed as indicated on the drawings or in accordance with information furnished before the WORK is started at the points affected. No chase shall be cut into any wall constructed of hollow units after it is built.

N. Build-in miscellaneous items to be set in masonry for which placement is not specifically provided under separate Sections, including reglets, lintels, ties, electrical panel boxes, equipment, sleeves, vents, grilles, anchors, grounds, and exterior electric conduits and fixtures.

1. Do not place dissimilar metals in contact with each other.

2. Embedded aluminum conduits, pipes, or accessories in masonry, grout, or mortar, shall be coated or covered with materials that will effectively prevent galvanic action; provide specific products per Section 09 96 00 – Protective Coatings.

O. Anchorage, attachment, and bonding devices shall be set so as to prevent slippage and shall be completely covered with mortar or grout.

P. Ties and reinforcing for masonry shall be provided under this Section.

Q. Steel lintels shall be furnished under Division 5 and installed under this Section in accordance with the details shown on the Contract Drawings.

R. Pointing: During the tooling of joints, except for weep holes, enlarge any voids or holes, and completely fill with mortar matching the color of the surrounding WORK as approved by ENGINEER and tool to match. Point-up joints at corners, openings, and adjacent WORK to provide a neat, uniform appearance and properly prepare joints for application of sealants where required.

S. Before final cleaning, repoint unsatisfactory joints as indicated and as determined by the ENGINEER.

3.6 INSTALLATION – THROUGH-WALL FLASHING

A. On horizontal masonry surfaces to be flashed, the flashing shall be laid in a fresh bed of mortar or trowel coat of asphalt mastic, while other surfaces receiving the flashing shall be thoroughly dry, free from loose materials, reasonably smooth, and sufficiently spotted with asphalt mastic to hold it in place until the masonry is set. Splices shall be accomplished in accordance with the Manufacturer's written instructions.

B. Through-wall flashing shall start 1/2-inch (12.7 mm) in from the outside face of the wall and go through the wall.

C. Head flashing shall start 1/2-inch (12.7 mm) in from the outside face of the wall and go through the wall. It shall be carried to the vertical masonry joint on each side of the opening and be turned up at the sides to form a pan. Corners shall be folded and not cut.

3.7 INSTALLATION – CAVITY WALL MESH

A. Cavity wall mesh shall be placed in the cavity wall continuously above through-wall flashing locations for the full cavity wall thickness, in accordance with the Manufacturer’s written instructions.

3.8 INSTALLATION – WEEPHOLES

A. Weepholes shall be placed vertically in mortar joint without impairing bending or impairing bond.

B. Weepholes shall be installed 24-inches (609.6 mm) on center in joints containing through wall flashing; except at masonry openings less than 48-inches (1219.2 mm) wide, where weepholes shall be spaced to allow for at least 2 weepholes equally spaced above each opening.

3.9 CLEANING, FINISHING, AND PROTECTION

A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of the CONTRACTOR.

2. Residue shall not be left on any surfaces.

B. Upon completion of the installation, masonry veneer and appurtenances shall be cleaned of dirt and other foreign matter to the satisfaction of the ENGINEER.

1. Cleaning shall be performed again immediately prior to acceptance of the WORK, when directed by the ENGINEER.

2. Cleaning shall be performed in accordance with the Manufacturer's written instructions.

3. Acid solutions shall not be used for cleaning any masonry veneer WORK.

4. Sandblasting shall not be used for cleaning any masonry veneer WORK.

5. High pressure washing shall not be used for cleaning any masonry veneer WORK.

6. Cleaning materials, means, and methods shall be tested on the field sample panel prior to continuing with cleaning the remaining WORK. A minimum of one week of dry weather is required to evaluate effectiveness of cleaning and effect on masonry and mortar by the ENGINEER.

7. Cleaning materials, means, and methods shall be compatible with masonry veneer WORK herein, with the surface applied water repellents in Section 07 19 00 – Surface Applied Water Repellent and Anti-Graffitiant.

8. Masonry veneer WORK that is not satisfactorily cleanable shall be replaced as determined by the ENGINEER.

9. Any streaking, discoloration, or staining that occurs will be considered a defect that will be required to be repaired by the CONTRACTOR

10. After mortar has thoroughly set and cured (3 weeks minimum during the summer; 5 weeks minimum during the winter), a sample wall area (approximately 20 sq. ft. 6.1 sq. m), shall be cleaned, with an approved commercial masonry cleaner, diluted, and mixed with potable water as recommended in writing by the Manufacturer. The sample area may be the field sample above or an area in the finish WORK as approved by the ENGINEER.

11. Any dilution of the cleaning materials shall be performed with clean water according to the instructions on the Manufacturer's printed label (container label).

12. The ENGINEER'S acceptance of sample cleaning shall be obtained before proceeding to clean remainder of masonry veneer WORK. A minimum of one week of dry weather is required to evaluate effectiveness of cleaning and effect on masonry and mortar. Upon acceptance by the ENGINEER, the rest of the masonry shall be cleaned by the same method.

    a. Acceptance of sample cleaning shall not relieve the CONTRACTOR from compliance with the Contract Documents.

C. Surfaces shall be brushed as WORK progresses and shall be maintained as clean as is practicable. Protect sills, ledges, offsets, etc. from mortar droppings. Unfinished WORK shall be raked back where possible, and toothed only where acceptable to the ENGINEER. The top of partially completed WORK shall be covered while WORK is not in progress. Before leaving fresh or unfinished WORK, walls shall be fully covered and protected against rain, wind, frost, or the elements. Covers of waterproof paper, tarpaulins, or other means, shall be draped over the wall, shall extend a minimum of 2-feet (0.61 m) down both sides, and shall be firmly held in place.

D. Exposed masonry shall be protected against staining by wall coverings, and excess mortar shall be wiped off the surface as the WORK progresses to reduce the amount of cleaning required at completion of the WORK.

E. The CONTRACTOR shall make adjustments required until accepted.

F. Products shall be protected from damage from subsequent construction operations.

G. The CONTRACTOR shall remove scratches and blemishes to the satisfaction of the ENGINEER.

H. Damaged or defective items shall be removed and replaced at the direction of the ENGINEER.

    1. Where ordered, remove masonry veneer units that are loose, chipped, broken, stained, or otherwise damaged, and units that do not match adjoining units and install new units in fresh mortar or grout, pointed to eliminate evidence of replacement, as approved by the ENGINEER.

    2. Remove and replace defective WORK, including the product that are otherwise unacceptable.

I. When WORK is completed, remove unused materials, containers, and equipment, and clean the Site of debris.

END OF SECTION

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SECTION 04 22 00 - REINFORCED CONCRETE BLOCK MASONRY

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide concrete masonry and appurtenant WORK, complete and in place, in accordance with the Contract Documents.

B. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.

B. Samples

1. If the required product is a colored and textured unit, the samples shall be colored and textured units. Submit samples of concrete masonry units illustrating colors and textures available for the ENGINEER to choose. Full size samples of the blocks selected shall be submitted for final approval after color selection, if requested.

2. Samples of mortar colors for color selection.

3. A minimum 4-ft square free-standing sample panel shall be prepared for approval before starting masonry WORK. The panel shall remain at the Site for reference until masonry WORK is completed.

C. Documentation

1. Reports from testing masonry units
2. Reports from mortar and grout testing.
3. Reports from prism testing.

D. Grout and mortar mix design

1. Proportions for components
2. Mill tests for cement
3. Admixture certification. Include chloride ion content.
4. Aggregate graduation and certification
5. Lime certification

1.3 QUALITY ASSURANCE

A. Applicable Standards: Concrete masonry shall conform to International Building Code (IBC), American Concrete Institute TMS 402 - Building Code Requirements for Masonry Structures, TMS 602 - Specification for Masonry Structures, and other applicable codes and standards of the governing authorities.

B. WORK shall conform to the standard of quality established by the approved free-standing sample panel.

C. Concrete block masonry units shall be sampled and tested in accordance with ASTM C 140 - Test Methods of Sampling and Testing Concrete Masonry and Related Units.

D. Testing of Mortar and Grout: The CONTRACTOR shall have the mortar and grout tested to assure compliance with the Specifications and the governing codes by a recognized testing laboratory approved by the ENGINEER. Test reports shall be submitted to the ENGINEER.

1. Tests shall be taken at the following times:

a. At commencement of masonry WORK, at least 2 test samples each of mortar and grout shall be taken on 3 successive Days.

b. At any change in materials or job conditions, at least 2 samples of each modified material, grout, and mortar shall be tested.

c. Make 4 random tests each of mortar and grout. The random test samples shall be taken when requested by the ENGINEER.

d. Additional samples and tests may be required whenever, in the judgment of the ENGINEER, additional tests beyond the 4 random tests are necessary to determine the quality of the materials.

e. The costs of tests and test reports, except for any additional tests requested by the ENGINEER, shall be paid by the CONTRACTOR as part of the WORK. The costs of the additional tests and reports, when reports verify compliance with the Contract Documents, will be paid by the OWNER. When tests or reports do not verify compliance, the cost of every additional test and report shall be paid by the CONTRACTOR.

2. Samples shall be stored in a moist environment until tested, unless directed otherwise by the ENGINEER or the testing laboratory. Testing for mortar shall be in accordance with ASTM C 270 - Mortar for Unit Masonry. Grout shall be tested per ASTM C 1019 - Standard Test Method for Sampling and Testing Grout.

E. Unit Strength Testing: The OWNER will test the masonry units to assure compliance with the Specifications and the governing Codes. Testing will be by a recognized testing laboratory.

1. Tests will be made of the following items:

a. Prior to construction, at least 6 masonry units shall be tested for each type of block herein, except separate tests are not required for block which only varies by texture.

b. At any change in materials during construction, at least 6 masonry units shall be tested.

c. One set of at least 6 masonry units will be tested for each masonry structure, besides the structure that the sample is part of, or for each week in which block is laid, for each type of block involved; whichever occurs first.

d. Additional sets of at least 6 masonry units shall be tested whenever, in the judgment of the ENGINEER, additional tests are necessary to determine the quality of the materials.

e. The CONTRACTOR shall submit a letter of certification from the CMU Supplier at the time of, or prior to, delivery of the materials to the Site that the materials used in construction are representative of the materials used to construct the prisms.

2. The masonry units shall be sampled and tested in accordance with ASTM C 140.

F. Inspection: Whenever required under the provisions of the Building Code, WORK hereunder will be subject to inspection by a Special Inspector selected by the ENGINEER and approved by the local Building Code representative having jurisdiction. Costs of such inspection will be paid by the OWNER. The Special Inspector will work under the supervision of the ENGINEER. Special inspection will be per Contract drawings and building code requirements.

G. Extreme Weather Construction: Cold weather construction shall be per the more stringent of TMS 602, OSSC Section 2104.3, and local Code requirements. Hot weather construction shall be per the more stringent of TMS 602, OSSC Section 2104.4, and local Code requirements.

H. Product Storage: Cement, lime, and other cementitious materials shall be delivered and stored in dry, weather-tight sheds or enclosures, in unbroken bags, barrels, or other approved containers, plainly marked and labeled with the manufacturers' names and brands. Mortar and grout shall be stored and handled in a manner that prevents the inclusion of foreign materials and damage by water or dampness. Masonry units shall be handled with care to avoid chipping and breakage, and shall be stored as directed in TMS 602. Materials stored on newly constructed floors shall be stacked in such manner that the uniformly distributed loading does not exceed 30 psf. Masonry materials shall be protected from contact with the earth and exposure to the weather and shall be kept dry and clean until used.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Concrete masonry units shall conform to ASTM C 90 - Load-Bearing Concrete Masonry Units. Units shall be normal weight units unless indicated otherwise.

B. Concrete masonry units shall be 12-inch by 8-inch by 16-inch modular size. Unit color and face style shall be per Architectural Contract drawings.

C. Concrete masonry veneer units shall be 4-inch by 8- inch by 16-inch size, with split faces. Units shall be integrally-colored with color selections from light and medium color range (white, black, and dark green are not included in color range).

D. Bond beam, corner, lintel, sill, and other specially shaped blocks shall be provided where required or necessary. Specially shaped non-structural blocks may be constructed by saw cutting. Color and texture shall match that of adjacent units.

E. Concrete masonry units at interior walls shall be normal weight block 12-inch by 8-inch by 16-inch modular size. All interior smooth faced concrete block, except fire-rated units, shall have recycled masonry content of at least 25 percent.

2.2 MATERIALS

A. Portland cement shall be Type I or II, low alkali, conforming to ASTM C 150 - Portland Cement.

B. Fly Ash shall conform to ASTM C618 – Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete, except that loss on ignition shall not be greater than 3 percent. Fly ash substitution, if used, shall be a minimum of 30 percent by weight of cement, but shall not exceed 40 percent.

C. Ground blast furnace slag cement shall conform to ASTM C989 - Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars, grade 100 or 120. Blended cements shall conform to ASTM C595 – Blended Hydraulic Cements, Type 1S, or ASTM C1157 – Performance Specification for Hydraulic Cement. Slag cement substitution, if used, shall be not less than 25 nor more than 50 percent by weight of cement. Slag cement substitution shall not be used with fly ash substitution.

D. Water-repellant and efflorescence control admixture

1. Provide integral water repellant admixture in block and in mortar in all exterior exposed concrete masonry walls, including exterior single-wythe walls, exposed faces of screen walls, retaining walls, and other locations as indicated on the drawings

2. For block, provide admixture as recommended by the manufacturer to obtain ASTM E 514-90–Standard Test Method for Water Penetration and Leakage Through Masonry – test extended to 72 hours, Class E rating. Admixtures shall be BASF “MasterPel 240”, Euclid Chemical Company “Eucon Blocktite”, or equal.

E. Hydrated lime shall be Type S conforming to ASTM C 207 - Hydrated Lime for Masonry Purposes.

F. Aggregate for mortar shall conform to ASTM C 144 - Aggregate for Masonry Mortar. Aggregate for grout shall conform to ASTM C 404 - Aggregates for Masonry Grout.

G. Water for mixing shall be clear potable water.

H. Reinforcing steel shall be deformed bars conforming to ASTM A 615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, Grade 60.

I. Joint reinforcing

1. Joint reinforcing shall conform to ASTM A 951 – Masonry Joint Reinforcement.

2. The minimum size of longitudinal and cross wires shall be W1.7 (9-gauge). Longitudinal wires shall be deformed. Maximum spacing of cross wires in ladder-type and points of connection of cross wires to longitudinal wire of truss-type shall be 16-inches.

3. Joint reinforcement shall be hot-dip galvanized after fabrication per ASTM A 153 – Zinc Coating (Hot-Dip) on Iron and Steel Hardware, Class B.

4. Corners and wall intersections shall use prefabricated corners and tees.

5. Joint reinforcement shall be continuous or

   a. lapped by 54 wire diameters in a grouted cell, or

   b. lapped by 75 wire diameters in a mortared bed joint, or

   c. in alternate bed joints of running bond masonry, lapped a distance not less than 54 diameters plus twice the spacing of the bed joints.

J. Integral water repellant admixture is required for mortar for exterior masonry units, and shall be **BASF MasterPel 240 MA, Euclid Blocktite Mortar Admixture,** or equal. The admixture shall not be detrimental to the bonding or help the process of efflorescence.

K. Admixture for grout shall be Sika Co., Sika Grout Aid, Type II, BASF Pozzolith, normal, or equal.

L. Veneer ties shall be per TMS 402 - Building Code Requirements for Masonry Structures and TMS 602 - Specifications for Masonry Structures. Additional ties shall be provided around openings larger than 16-inches in either direction.

M. Masonry cleaner shall be a non-acidic cleaner, **SafEtch by Prosoco, Inc.,** or equal.

2.3 MORTAR

A. Mortar for concrete block masonry shall conform to ASTM C 270 and OSSC section 2103.7 for cement-lime Type M or S, with a minimum 28 Day compressive strength of 2800 psi.

B. Mortar for use with colored masonry units shall have integral color matching block color.

2.4 GROUT

A. Grout shall conform to ASTM C 476 - Grout for Masonry and have a minimum 28 Day compressive strength of 2000 psi. Where the grout space is less than 4-inches, coarse aggregate shall be omitted.

B. Admixtures may only be used when approved by the ENGINEER. If approved for use, admixtures shall be used in accordance with the manufacturer's published recommendations for the grout.

PART 3 EXECUTION

3.1 GENERAL

A. Measurements for mortar and grout shall be accurately made. Shovel measurements are not acceptable. Mortar proportions shall be accurately controlled and maintained.

B. WORK shall be performed in accordance with the provisions of TMS 402, 602, the OSSC, and the local codes for reinforced concrete hollow-unit masonry.

C. The CONTRACTOR shall set or embed anchors, bolts, reglets, sleeves, conduits, and other items as required.

D. Block cutting shall be by machine.

E. Masonry units shall be supported off the ground and shall be covered to protect them from rain. Only clean, dry, uncracked units shall be incorporated.

F. Reinforcing steel shall be cleaned of loose rust and scale, oil, dirt, paint, laitance, or other substances that may be detrimental to or reduce bonding of the steel and concrete.

G. Immediately before starting WORK, concrete upon which the masonry will be laid shall be cleaned with water under pressure.

H. Full mortar joint for first course shall be provided.

I. Units shall be shoved tightly against adjacent units to assure good mortar bond.

J. Equipment for mixing and transporting the mortar and grout shall be clean and free from set mortar, dirt, or other foreign matter.

3.2 MIXING

A. Mortar shall be mixed by placing 1/2 of the water and sand in the operating mixer, after which the cement, lime, and remainder of the sand and water shall be added. After ingredients are in the mixer, they shall be mechanically mixed for not less than 5 minutes. Retempering shall be done on the mortar board by adding water within a basin formed within the mortar, and the mortar reworked into the water. Mortar that is not used within one hour shall be discarded.

3.3 ERECTION OF CONCRETE BLOCK MASONRY

A. Masonry WORK shall be erected in plane, plumb, level, straight and true to dimensions, and be executed in accordance with acceptable practices of the trade and the tolerances of TMS 602.

B. Unless indicated otherwise, masonry shall be laid up in straight uniform courses with running bond.

C. Masonry shall be erected to preserve the unobstructed vertical continuity of the cells measuring not less than 3 inches by 3 inches in cross-section. Walls and cross webs shall be full bedded in mortar. Head (or end) joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells.

3.4 JOINTS

A. Vertical and horizontal joints shall be uniform and approximately 3/8 inch wide. Exterior joints and interior exposed block joints shall be concave-tooled to a dense surface. Special care shall be used in tooling joints so as to match existing construction. Interior or exterior non-exposed masonry and masonry behind plaster shall have flush joints.

3.5 CLEANOUTS

A. Cleanout openings shall be provided at the bottoms of cells to be filled at each lift or pour of grout where such lift or pour is over 4 feet in height. Any overhanging mortar or other obstructions or debris shall be removed from the insides of such cell walls. The cleanouts shall

be sealed before grouting and after inspection. Cleanout openings shall match the finished wall in exposed masonry.

3.6 REINFORCEMENT

A. Deep cut bond beam blocks shall be used where horizontal reinforcing steel is embedded. H-block bond beams may be used at locations other than openings.

B. Knock-out openings shall have no steel or joint reinforcing running through the opening. Head, jambs, and sill blocks shall be used to provide an even finish surface to install windows when blocks are removed. Joints at heads, jambs, and sills shall be stacked and continuous.

C. Vertical reinforcement shall be held in position at top and bottom and at intervals not exceeding 12 diameters of the reinforcement.

3.7 GROUTING

A. Cells containing reinforcing and bond beam spaces shall be filled solidly with grout unless indicated otherwise. Grouting shall not be started until the wall has cured for 24 hours. Grout shall not be poured in more than 5-ft lifts.

B. Grout shall be consolidated at time of pouring by puddling or vibrating. If the grouting operation has been stopped for one hour or longer, horizontal construction joints shall be formed by stopping the grout pour 1-1/2 inches below the top of the uppermost unit.

3.8 PIPE OR CONDUITS EMBEDDED IN MASONRY

A. Pipes, conduits, and sleeves passing vertically or horizontally through the masonry shall not be placed closer than 3 diameters on center, nor shall they impair the strength of the construction. Pipes, conduits, and sleeves passing vertically shall not be placed in the same cell as the vertical reinforcing. Pipes, conduits, and sleeves passing horizontally shall not be placed in a bond beam.

B. Maximum area of vertical conduits, pipes, or sleeves placed in masonry columns or pilasters shall not displace more than 2 percent of the net cross section.

3.9 PROTECTION

A. Wall surfaces shall be protected from droppings of mortar or grout during construction.

3.10 FINISHING AND CLEANING

A. Masonry shall not be wet-finished unless exposed to extreme hot weather or hot wind and then only by using a nozzle-regulated fog spray sufficient only to dampen the face but not of such quantity to cause water to flow down over the masonry.

B. Finish masonry shall be cleaned and pointed in a manner satisfactory to the ENGINEER, based upon the standards established by the approved sample panel.

C. Interior and exterior colored masonry WORK exposed to view shall be cleaned by whip light sandblasting to remove stains and other imperfections.

D. Exposed masonry surfaces of openings and window and door openings such as sills, heads, and jambs shall be finish block surfaces, not formed surfaces, unless indicated otherwise. Closed bottom bond beam blocks shall be used at heads and sills. Pour holes may be used at the sill under window frame and where approved by the ENGINEER.

3.11 VENEER TIES

A. Veneer ties shall be provided per Building Code, TMS 402 and 602 trade standards, and as indicated where veneered surfaces are indicated.

END OF SECTION

SECTION 05 05 19 – POST-INSTALLED ANCHORS IN CONCRETE

PART 1 GENERAL

1.1 THE SUMMARY

A. Provide post-installed anchors and appurtenances, complete and in place, as indicated in accordance with the Contract documents.

B. Unless otherwise indicated, drilled concrete anchors shall be adhesive anchors.

C. Section Includes:

1. Adhesive anchors
2. Expansion anchors
3. Screw anchors
4. Undercut anchors (dynamic loading)

D. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Definitions

1. Epoxy anchors are considered to be adhesive anchors.

2. Expansion anchors, screw anchors, and undercut anchors are considered to be mechanical anchors.

B. References

1. ICC ES AC 193 – Mechanical Anchors in Concrete Elements
2. ICC ES AC 308 –Post Installed Adhesive Anchors in Concrete Elements
3. NSF 61 – NSF/ANSI 61-2016 Drinking Water System Components – Health Effects

1.3 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.

B. Submit the following:

1. Product data and technical information

2. Safety Data Sheets (SDS) for adhesives

3. Manufacturer’s literature containing installation instructions and appropriate uses for each type of post-installed anchor and location of use

4. Current ICC-ES or IAPMO-UES Evaluation Reports

5. Certification for each installer demonstrating that they have been qualified in accordance with the Quality Assurance requirements below

C. No substitution for the indicated anchors will be considered unless accompanied with an ICC-ES or IAPMO-UES report verifying strength and material equivalency.

D. Complete structural calculations and anchorage details shall be prepared and submitted by the Contractor for all anchors and anchor groups that are shown but not completely detailed (type, size, location, spacing and embedment) on the Contract Documents. Calculations and anchorage details shall be completed and submitted in accordance with Section 01 33 17 – Structural Design, Support and Anchorage.

1. Where adhesive anchors are used for structural applications (such as dowels between new and existing concrete) and an embedment depth is not shown on the contract documents, the anchor shall be installed in accordance with Method 1 or Method 2 below:

a. Method 1: The minimum depth of embedment shall be greater than or equal to the development length (ld) determined in accordance with ACI 350 for a cast in place reinforcing bar of the same diameter and grade, unless it can be shown by calculation that the anchor spacing and edge distance is sufficient to develop the tensile strength of the anchor in a lesser depth of embedment. Calculations shall be submitted in accordance with Section 01 33 00 – Contractor Submittals.

b. Method 2: Adhesive anchors in concrete that cannot develop the tensile capacity of the steel element may be used to transfer forces, provided that the loads on the anchor are amplified by the system overstrength factor (Ωo) in Table 12.2-1 of ASCE 7-10, or where unreduced forces are used in accordance with ASCE 41-13 for existing structures. Calculations shall be submitted in accordance with Section 01 33 00 – Contractor Submittals.

1.4 QUALITY ASSURANCE

A. Special inspection for all post-installed anchor installations shall be provided:

1. As recommended or required by the ICC-ES or IAPMO-UES report.
2. As required by the enforceable building code.
3. As otherwise indicated in the Contract Documents.

B. The most stringent of the above requirements shall be used. The cost of Special Inspection of post-installed anchors shall be paid for by the OWNER.

C. Before installing adhesive anchors in the WORK, anchor installers shall be trained and qualified at the Site by the manufacturer's representative. Training and qualification for each installer shall include at least:

1. Hole drilling procedure, hole preparation and cleaning techniques, adhesive injection technique and dispenser training/maintenance, rebar dowel preparation and installation, and proof loading if required.

2. Each installer shall be re-qualified every 6 months for the duration of the project by the same qualifying procedure.

D. Before installing mechanical anchors in the WORK, anchor installers shall be trained and qualified at the Site by the manufacturer's representative. Training and qualification for each installer shall include at least:

1. Hole drilling procedure, hole preparation and cleaning techniques, and torqueing.

2. Each installer shall be re-qualified every 6 months for the duration of the project by the same qualifying procedure.

E. Defective anchors noted by the Special Inspector shall be replaced and re-installed by the CONTRACTOR without any additional compensation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to job site in manufacturer’s or distributor’s packaging undamaged, complete with installation instructions.

B. Protect and handle materials in accordance with manufacturer’s recommendations to prevent damage or deterioration.

C. Anchoring adhesives shall be stored at temperatures prescribed by the manufacturer and must not be used beyond the expiration date.

1.6 SITE CONDITIONS

A. Post-installed anchors shall be installed in concrete having a minimum age of 21 days at time of anchor installation.

B. The anchor or fastener coating, plating, or steel type must provide suitable corrosion resistance for the environment in which the anchor or fastener is installed. Anchors, nuts, and washers in the locations listed below shall be fabricated from type 316 or 304 stainless steel:

1. buried locations

2. submerged locations

3. locations subject to seasonal or occasional flooding

4. inside hydraulic structures below the top of the structure

5. inside buried vaults, manholes, and structures that do not drain through a gravity sewer or to a sump with a pump

6. chemical handling areas

7. inside trenches, containment walls, and curbed areas

8. locations indicated or designated by the ENGINEER to be provided with stainless steel anchors.

PART 2 PRODUCTS

2.1 ADHESIVE ANCHORS

A. General

1. The adhesive anchor system shall consist of: 1) adhesive product; and 2) threaded rod or reinforcing bar insert. The complete system shall be compatible as required by the adhesive manufacturer.

2. Adhesives shall be injectable, two-component, cartridge-type systems dispensed and mixed through a static mixing nozzle supplied by the manufacturer.

3. The evaluation report issued by ICC-ES or IAPMO-UES shall state the acceptability of the adhesive anchor for the intended purpose and location.

4. Adhesive anchors shall be permitted when regular ambient temperatures are consistent with manufacturer's recommendation for long and short term temperatures.

5. Adhesive anchors shall not be used where anchors are subject to vibration or fire.

6. Adhesive anchors shall not be used in overhead applications.

7. Where required, adhesive shall be capable of being used in submerged applications once cured.

B. Adhesive Anchors in Concrete

1. Threaded rod inserts shall meet the requirements of Section 05 50 00- Miscellaneous Metalwork.

2. Reinforcing dowel inserts shall meet the material requirements of Section 03 21 00 – Reinforcement Steel and 03 31 00 – Cast-in-Place Concrete.

3. Adhesive for use in concrete adhesive anchors shall be certified for use in resisting seismic loads in cracked concrete applications in accordance with ICC-ES AC 308.

4. Where not detailed on the drawings, adhesive anchors shall be designed in accordance with ACI 318 as amended by the specific design provisions of ICC-ES AC 308.

5. Adhesive anchors shall have an evaluation report issued by ICC-ES or IAPMO-UES and shall have been tested and qualified for performance in cracked and uncracked concrete in accordance ICC-ES AC308 to resist static, wind, and earthquake (Seismic Design Categories A through F).

6. Adhesive anchors for concrete shall be HIT-RE 500 V3 by Hilti or SET-XP by Simpson Strong-Tie, or equal.

2.2 EXPANSION ANCHORS

A. General

1. Expansion anchors are post-installed torque-controlled mechanical expansion anchors used to resist structural loads.

2. Expansion anchors shall be an imperial sized, threaded stud with an integral cone expander, expansion clip, nut and washer.

3. Lead caulking anchors will not be permitted.

4. Non-embedded buried or submerged anchors shall be fabricated from stainless steel.

5. The evaluation report issued by ICC-ES or IAPMO-UES shall state the acceptability of the expansion anchor for the intended purpose and location.

6. Anchors subjected to dynamic or vibratory loading shall be suitable for the intended loading and location as indicated in the manufacturer's technical product data.

B. Expansion Anchors for Concrete

1. Anchors shall be designed in accordance with ACI 318, which requires post-installed mechanical anchors to be qualified according to ACI 355.2.

2. Anchors shall have an evaluation report issued by ICC-ES or IAPMO-UES and have been tested and qualified for performance in cracked and uncracked concrete in accordance with ACI 355.2 and ICC-ES AC193.

3. Expansion anchors shall be Strong-Bolt 2 by Simpson Strong-Tie, Kwik-Bolt TZ by Hilti, or equal.

2.3 SCREW ANCHORS

A. General

1. Screw anchors used in exterior and corrosive environments shall be fabricated from stainless steel.

2. The evaluation report issued by ICC-ES or IAPMO-UES shall state the acceptability of the screw anchor for the intended purpose and location.

3. Anchors subjected to dynamic or vibratory loading shall be suitable for the intended loading and location as indicated in the manufacturer's technical product data.

B. Screw Anchors for Concrete

1. Anchors shall be designed in accordance with ACI 318 as amended by the specific design provisions of ICC-ES AC193.

2. Anchors shall have an evaluation report issued by ICC-ES or IAPMO-UES and have been tested and qualified for performance in cracked and uncracked concrete in accordance with ICC-ES AC193.

3. Screw anchors for concrete shall be Titen HD by Simpson Strong-Tie, Kwik HUS-EZ (KH-EZ) by Hilti, or equal.

2.4 UNDERCUT ANCHORS

A. General

1. Undercut anchors are post-installed mechanical anchors that require pre-drilling and a special undercut notch configuration cut into the concrete before installation.

2. Self-undercutting anchors are post-installed torque-controlled mechanical anchors that cut their own undercut notch by application of a setting torque that forces a sleeve over a cone.

3. The evaluation report issued by ICC-ES or IAPMO-UES shall state the acceptability of the undercut anchor for the intended purpose and location.

4. Anchors subjected to dynamic or vibratory loading shall be suitable for the intended loading and location as indicated in the manufacturer's technical product data.

5. Undercut anchors used in exterior and corrosive environments shall be fabricated from stainless steel.

B. Undercut Anchors for Concrete

1. Anchors shall be designed in accordance with ACI 318 as amended by the specific design provisions of ICC-ES AC193.

2. Anchors shall have an evaluation report issued by ICC-ES or IAPMO-UES and have been tested and qualified for performance in cracked and uncracked concrete in accordance with ACI 355.2 and ICC-ES AC193.

3. Undercut anchors for concrete shall be HDA by Hilti or equal.

PART 3 EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Post-installed anchors shall be installed in strict accordance with the manufacturer's instructions, the ICC-ES or IAPMO-UES report, and project specific design requirements indicated on the Contract Documents or in the design calculations provided by the CONTRACTOR per Section 1.3.D.

B. Where holes are drilled in concrete, holes shall be accurately and squarely drilled, and the holes shall be cleaned in accordance with the manufacturer's recommendations.

C. Post-installed anchors shall not be installed until the concrete has reached the required 21 days or per manufacturer's requirements, whichever is longer.

D. Acceptable installation and performance temperature ranges shall be verified with manufacturer's literature prior to installation. Minimum substrate temperatures shall be maintained during the full curing period as required by the manufacturer.

E. Adhesive anchors shall not be loaded until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

F. The CONTRACTOR shall identify the position of reinforcing steel and other embedded items prior to drilling holes. Care shall be exercised in drilling to avoid damaging existing reinforcing or embedded items. The location of drilled holes shall be adjusted to avoid drilling through or cutting any existing reinforcing bars or embedded items. Notify the ENGINEER if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and communications conduit, and piping.

G. Core drilling of holes is not allowed.

H. Identification of reinforcing steel and/or embedded items, relocation of drilled holes and adjustments or modifications to anchored or fastened items shall be considered part of the WORK and shall be provided at no additional cost to the OWNER.

I. All abandoned drilled holes shall be repaired in accordance with Section 03 01 30 Concrete Repair and Rehabilitation at no additional cost to the OWNER.

END OF SECTION

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SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide structural steel framing and appurtenant metal parts required for permanent connection of the structural steel system, complete and in place, in accordance with the Contract Documents.

B. The design, fabrication, and erection of structural steel elements in buildings and non-building structures, and elements thereof, shall be in accordance with the 2019 Oregon Structural Specialty Code (OSSC), AISC 360 and AISC 341.

C. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 REFERENCED STANDARDS

A. The edition of the standards applicable to the WORK shall be those editions referenced by the 2019 OSSC. If the standard is not referenced by the OSSC, nor an OSSC-referenced standard listed below, the edition of the standard applicable to the WORK shall be the edition in effect on the date of award of this contract.

B. Federal Specifications and Commercial Standards

AISC 303 Code of Standard Practice for Steel Buildings and Bridges

AISC 341 Seismic Provisions for Structural Steel Buildings

AISC 358 Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications

AISC 360 Specification for Structural Steel Buildings

ASTM A36 Standard Specification for Carbon Structural Steel

ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A193 Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

ASTM A194 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both

ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength

ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A992 Standard Specification for Structural Steel Shapes

ASTM F3125 Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength

AWS B1.5 Standard for the Qualification of Welding Inspectors

AWS D1.1 Structural Welding Code – Steel

AWS D1.8 Structural Welding Code – Seismic Supplement

RCSC Specification for Structural Joints Using High-Strength Bolts

1.3 CONTRACTOR SUBMITTALS

A. Submit in accordance with Section 01 33 00 - Contractor Submittals.

B. Shop Drawings, including fabrication and erection drawings for all WORK, shall conform to AISC recommendations and specifications and shall show all holes, etc. required for other work. Drawings shall include complete details showing members and their connections, anchor bolt layouts, schedules for fabrication procedures, and diagrams showing the sequence of erection.

C. Testing laboratory certifications for shop and field welders shall be submitted directly to the ENGINEER with copies to the CONTRACTOR and others as required.

D. Contractor's Statement of Responsibility, as required by the OSSC Section 1704.4

E. Quality Control inspection reports.

1.4 QUALITY ASSURANCE

A. Quality Assurance shall be provided as required by the OSSC, AISC 360, and AISC 341.

1. Special Inspections and Tests requirements indicated in the OSSC Chapter 17, and Quality Assurance requirements indicated in AISC 360 Chapter N and AISC 341 Chapter J, will be provided by and paid for by the OWNER.

2. Structural Observations, if required by the Building Official or requested by the OWNER, will be provided by and paid for by the OWNER.

3. Contractor Responsibility requirements indicated in the OSSC Chapter 17 shall be provided by and paid for by the CONTRACTOR.

B. The CONTRACTOR shall be aware of all Quality Assurance requirements, and shall provide advance notice and full access to the OWNER and ENGINEER to conduct the inspections, tests, and observations.

1. For inspections and tests at locations away from the project site, a minimum of 14 days' notice shall be provided in writing.

2. For inspections, tests and observations at the project site, a minimum of 7 days' notice shall be provided in writing.

3. The CONTRACTOR shall provide safe access, including fall protection equipment, to all locations necessary to conduct the inspections, tests, and observations.

C. The CONTRACTOR shall supply material for testing at no cost to the OWNER and shall assist the ENGINEER in obtaining material for test samples.

D. The CONTRACTOR shall correct or repair all defective WORK. All costs associated with corrections, repairs, and retesting shall be paid for by the CONTRACTOR.

E. Refer to PART 2 for Quality Control requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Structural steel

Wide Flange Shapes	ASTM A992
Other Shapes, Plates, Bars	ASTM A36
Pipe, Pipe Columns, Bollards	ASTM A53, Type E or S, Grade B standard weight unless noted otherwise
HSS	ASTM A500 Grade B

B. Bolts for connections shall be ASTM F3125 Grade A325, unless indicated otherwise.

1. ASTM F3125 Grade A490 bolts shall be used where indicated.

2. Use of ASTM F3125 Grade F1852 or Grade F2280 Twist-Off/Tension-Control bolts in place of Grade A325 or Grade A490 Heavy Hex Head bolts, respectively, is subject to ENGINEER approval.

C. Bolts used to connect dissimilar metals shall be ASTM A193 and A194, Type 316 stainless steel.

D. Welded anchor studs shall be headed concrete anchor studs (HAS), or deformed bar anchors (DBA), or threaded studs (TAS), as indicated on the Drawings and as supplied by **Nelson Stud Welding Company**, **Omark Industries, KSM Fastening Systems Division,** or equal.

E. Structural steel shall be cleaned and coated in accordance with Section 09 96 00 - Protective Coating.

F. Steel members in contact with aluminum shall be galvanized per Section 05 50 00 - Miscellaneous Metalwork, unless indicated otherwise.

G. Structural members shall be furnished full length without splices unless otherwise indicated or approved by the ENGINEER.

2.2 QUALITY CONTROL

A. Quality Control shall be provided as required by AISC 360 and AISC 341.

1. Quality Control requirements indicated in AISC 360 Chapter N and AISC 341 Chapter J shall be provided by and paid for by the CONTRACTOR.

PART 3 EXECUTION

3.1 MEASUREMENT

A. The CONTRACTOR shall verify dimensions and shall make any field measurements necessary and shall be fully responsible for accuracy and layout of WORK. The CONTRACTOR shall review the Drawings, and any discrepancies shall be reported to the ENGINEER for clarification prior to starting fabrication.

3.2 FABRICATION

A. Structural steel shall be fabricated in accordance with the Drawings, AISC Specifications, AWS Codes, and the Shop Drawings.

B. Materials shall be properly marked and match-marked for field assembly.

C. Where finishing is required, assembly shall be completed including bolting and welding of units, before start of finishing operations.

3.3 BOLTED CONSTRUCTION

A. The CONTRACTOR shall comply with the requirements of the AISC and RCSC specifications applicable to bolted connections.

B. Surfaces for slip-critical connections shall be prepared in accordance with RCSC specifications.

3.4 WELDED CONSTRUCTION

A. The CONTRACTOR shall comply with the AISC specifications, AWS D1.1 and AWS D1.8 for procedures, appearance, and quality of welds and welders, and methods used in correcting Defective WORK. Welded architectural metal that is exposed to view shall have welds ground smooth. Shielded metal arc welding method or gas metal arc welding methods shall be used for welding structural steel.

B. Unless otherwise indicated, butt and bevel welds shall be complete penetration.

3.5 HOLES FOR OTHER WORK

A. Holes shall be provided as necessary or as indicated for securing other WORK to structural steel framing, and for the passage of other WORK through steel framing members. No torch cut holes will be permitted.

3.6 SHOP PAINT PRIMER

A. Shop paint primer shall be applied in accordance with Section 09 96 00 – Protective Coating. Omit shop-applied primer at field weld locations, for the portion of a member to be embedded in concrete, and where galvanizing with no further coating is required.

3.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Structural members shall be loaded in such a manner that they may be transported and unloaded without being excessively stressed, deformed, or otherwise damaged.

B. Structural steel members and packaged materials shall be protected from corrosion and deterioration. Material shall be stored in a dry area and shall not be placed in direct contact with the ground. Materials shall not be placed on the structure in a manner that might cause distortion or damage to the members or the supporting structures. Repair or replace damaged materials or structures as directed.

3.8 ERECTION

A. The CONTRACTOR shall comply with the AISC Specifications and Code of Standard Practice, and with indicated requirements.

B. High-strength bolts shall be installed in accordance with the RCSC Specification. The connections shall be the slip-critical, unless indicated otherwise.

C. Anchor rods and other connectors required for securing structural steel to in-place WORK and templates and other devices for presetting bolts and other anchors to accurate locations shall be furnished by the CONTRACTOR.

D. The CONTRACTOR shall be responsible for designing and installing any temporary bracing required for the safe erection of structural steel members.

3.9 SETTING BASES AND BEARING PLATES

A. Prior to the placement of non-shrink grout beneath base and bearing plates, the bottom surface of the plates shall be cleaned of all bond-reducing materials, and concrete and masonry bearing surface shall also be cleaned of all bond-reducing materials and be roughened to improve bonding.

B. Loose and attached baseplates and bearing plates for structural members shall be set on wedges, leveling nuts, or other adjustable devices.

C. Anchor rods shall be tightened after the supported members have been positioned and plumbed and the non-shrink grout has attained its indicated strength.

D. Baseplates shall be grouted with non-shrink grout to assure full uniform bearing. Grouting shall be done prior to placing loads on the structure.

3.10 FIELD ASSEMBLY

A. Structural frames shall be set accurately to the lines and elevations indicated. The various members shall be aligned and adjusted to form a part of a complete frame or structure before

permanently fastening. Bearing surfaces and other surfaces that will be in permanent contact shall be cleaned before assembly. Necessary adjustments to compensate for discrepancies in elevations and alignments shall be performed.

B. Individual members of the structure shall be leveled and plumbed within AISC tolerances.

C. Required leveling and plumbing measurements shall be established on the mean operating temperature of the structure.

3.11 MISFITS AT BOLTED CONNECTIONS

A. Where misfits in bolting are encountered, the ENGINEER shall be immediately notified. The CONTRACTOR shall submit a method to remedy the misfit for review by the ENGINEER. The ENGINEER will determine whether the remedy is acceptable or if the member must be refabricated.

B. Incorrectly sized or misaligned holes in members shall not be enlarged by burning or by the use of drift pins.

C. Correction of misfits is part of the WORK.

3.12 GAS CUTTING

A. Gas cutting torches shall not be used in the field for correcting fabrication errors in the structural framing, except when approved by the ENGINEER. Gas-cut sections shall be finished equal to a sheared appearance.

3.13 TOUCH-UP PAINTING

A. Immediately after erection, field welds, bolted connections, and abraded areas shall be cleaned of the shop paint primer. Touch-up paint primer applied by brush or spray shall be the same thickness and material as used for the shop coat. Galvanized surfaces that have been field welded or damaged shall be repaired in accordance with Section 05 50 00 – Miscellaneous Metalwork.

B. Finish coating of structural steel shall be as indicated in Section 09 96 00 – Protective Coating.

END OF SECTION

SECTION 05 21 19 - OPEN WEB STEEL JOISTS

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide the open web steel joists, complete and in place, in accordance with the Contract Documents.

B. Variation of Dimensions: The dimensions indicated for the joists, as well as depth of members and thickness of chords, are for general design control purposes. Minor variations from these dimensions, if required to accommodate manufacturing standards, etc., will be allowed.

C. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.

B. Shop Drawings

1. Design calculations, erection drawings, and Shop Drawings shall be designed by a professional engineer registered in the State of Oregon.

2. Complete design calculations for the particular unit or system utilized, including maximum stresses in individual members and other information pertinent to the design.

3. Complete design calculations for the connections of any special forces between the steel joists and the supporting elements of the walls, beams, and columns, where such forces are specifically indicated.

4. Shop and erection drawings shall include at least the following items:

   a. General layout plan of joists, with number, type, locations and spacing, anchorage, and coating, including overall dimensions.

   b. Fabrication and erection details.

   c. Connections and anchoring details.

   d. Bridging size, location, and connection details.

   e. Sizes and locations of openings.

   f. Sizes and locations of mechanical and electrical equipment supported by the roof system that may affect the design for fabrication.

5. Mill certificates for materials. Certificates shall be approved before fabrication begins.

1.3 QUALITY CONTROL

A. Joists will be inspected by the ENGINEER before shipment to ensure compliance of materials and workmanship with the requirements of these Specifications.

PART 2 PRODUCTS

2.1 DESIGN CRITERIA

A. Open web steel joists and bridging shall be designed to meet the structural and fire requirements of the latest edition of the applicable building code and governing fire codes.

B. Open web steel joist members and their connections shall either be designed for the uniform loads as indicated for the Steel Joist Institute designation or be designed to adequately support loads as indicated or as called for by applicable codes.

C. The CONTRACTOR shall coordinate the location of concentrated mechanical and electrical equipment loads on the joists.

2.2 MATERIALS

A. General: Materials utilized in the WORK but not specifically mentioned in this Section shall be governed by the latest applicable ASTM Standards.

B. Design: Design of steel joists and bridging shall be in accordance with the latest Steel Joist Institute Specifications.

C. Steel: The steel used in the manufacture of chord and web sections shall conform to the Steel Joist Institute Standard Specifications and applicable ASTM Standards.

D. Mechanical Properties: The yield strength used as basis for the design stress shall be either 36,000 psi or 50,000 psi. Mill certificates shall be submitted for materials for review and approval before fabrication can begin.

E. Design Verification Test: The manufacturer shall, at the time of design review by the ENGINEER, verify joist capacities in accordance with the Steel Joist Institute requirements.

F. Welding: Welding shall conform to the latest Steel Joist Institute Specifications and AWS D1.1.

G. Coating shall be in accordance with Section 09 96 00 - Protective Coating. After erecting and welding are complete, welds and scarred surfaces on the joists shall be given a touch-up coat of the same paint as shop coat.

PART 3 EXECUTION

3.1 ERECTION REQUIREMENTS

A. Handling and Erection: Handling and erection shall be in accordance with the latest Steel Joist Institute specifications and the requirements below:

B. Care shall be exercised to avoid damage through careless handling during unloading, storing, and erecting.

1. Erection of steel joists shall be performed by personnel experienced in this type of work.

2. Sequence of erection shall be thoroughly outlined prior to starting, and any special sequence outlined by the ENGINEER shall be strictly adhered to.

3. Base lines and elevations shall be established by the CONTRACTOR prior to the start of erection.

4. Bearing surfaces shall be prepared to a true and level line.

5. Erect and place joists safely. Each element shall be set in proper position as shown on the reviewed erection drawings, carefully plumbed, and anchored securely to the supporting structural elements.

6. As soon as joists are erected, bridging shall be completely installed and the joists permanently fastened into place before the application of any loads.

7. Field welding shall not damage the joists. The total length of weld at any one point on cold-formed members whose yield strength has been attained by cold working and whose as-formed strength is used in the design shall not exceed 50 percent of the overall developed width of the cold-formed section.

C. Completion: Units shall be in place, properly and completely anchored, and approved before any finishes are applied. Any damaged units, where in the opinion of the ENGINEER, suitable and adequate repairs cannot be made, will be rejected, whether or not delivered or erected; and whole, approved replacement units shall be provided by the CONTRACTOR.

END OF SECTION

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SECTION 05 30 00 - METAL DECKING

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide steel decking and accessory items, complete and in place, in accordance with the Contract Documents.

B. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Specifications and Commercial Standards

AISI Design of Cold - Formed Steel Structural Members.

SDI Design Manual for Composite Decks, Form Decks, and Roof Decks.

ASTM A 446Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

ASTM A 653General Requirements for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) by the Hot-Dip Process.

ASTM A 611Steel, Sheet, Carbon, Cold-Rolled, Structural Quality

AWS D1.3 Structural Welding Code-Sheet Steel

B. ICC-ES or IAPMO-UES Evaluation Reports for each type of metal decking used in the WORK.

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.

B. Prior to the commencement of any WORK, the CONTRACTOR shall submit an affidavit furnished by the deck manufacturer certifying to the yield strength. The CONTRACTOR shall submit gauge and section properties of the metal deck. The CONTRACTOR shall also furnish the diaphragm shear values for the deck using the welding pattern and/or shear capacity indicated. Failure to conform to this requirement shall be justification for rejection of the material.

C. Submit a layout drawing showing the location of deck sheets, end laps, side laps, types and locations of welds and details of accessories.

D. Submit an ICC-ES or IAPMO-UES Evaluation Report for each type of metal decking used in the WORK.

1.4 QUALITY ASSURANCE

A. No insulation, roofing materials, or other permanent coverings shall be placed over the decking until the ENGINEER has inspected it for placement, welds, and accessories. Stored materials and debris shall be removed to facilitate the inspection. Welds found to be defective shall be replaced as a part of the WORK.

1.5 MATERIAL STORAGE

A. Decking stored at the Site before installation shall be stacked on the ground on platforms or pallets and be covered with tarpaulins or other weatherproof covering.

PART 2 PRODUCTS

2.1 STEEL DECK

A. Unless indicated otherwise, metal deck shall be manufactured from steel conforming to ASTM A 611, Grades C, D, or E; or A 446, Grades A, B, C, D, E, or F, or equal, having a minimum yield strength of 33,000 psi. The maximum design working stress in the deck shall not exceed the product of 0.6 times the yield strength.

B. The metal deck structural properties shall be as indicated. The moment of inertia and section modulus of the metal deck unit shall be computed in accordance with the Steel Deck Institute specifications, and in accordance with the American Iron and Steel Institute, "Specification for the Design of Cold-Formed Steel Structural Members."

C. Steel decking shall be galvanized and shall conform to ASTM A 653 and to the applicable requirements of Section 05 50 00 - Miscellaneous Metalwork. Steel deck shall be free of oil, grease, and dirt before dipping.

D. Steel deck shall be finished in accordance with Section 09 96 00 - Protective Coatings. Deck shall be free of oil, grease and dirt before coating application.

E. The metal deck shall have sheet length that covers 3 or more spans.

F. The metal deck sheets shall be formed at the longitudinal sides in such a manner that they will overlap and/or interlock. Where the end of sheets overlap, they shall be die-formed in such a manner that the sheet in the next row telescopes and snugly overlaps the sheet laid previously.

G. Plates needed to connect decking to supports or to maintain deck continuity shall be 14-gauge galvanized sheet.

H. Structural steel shapes, including angles and inserts, shall be in accordance with Section 05 12 00 - Structural Steel Framing.

2.2 MANUFACTURERS

A. The metal decking shall be manufactured by Verco Manufacturing Company, ASC Pacific Inc., Vulcraft Nucor Corporation Inc., or equal.

PART 3 EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. The CONTRACTOR shall inspect supporting members for correct layout and alignment, and shall not proceed with installation until defects are corrected and supporting members are completely installed and secured.

B. Metal deck sheets and accessories shall be placed in accordance with the manufacturer's recommendations and the Shop Drawings. Roofs having a slope of 1/4-inch per foot or more shall be installed starting at the low side, to ensure that end laps are shingle fashion.

C. Metal deck sheets shall be positioned on supporting steel framework and adjusted to final position with ends bearing a minimum of 2-inches on supporting members. Units shall be placed end to end, with ribs aligned over the entire length of the run before being permanently fastened.

D. Special care shall be exercised not to damage or overload the deck during installation. The deck shall not be used for storage or as working platforms until permanently secured in position. Construction loads shall not exceed the deck carrying capacity, as recommended by the manufacturer.

E. Openings in the deck shall be cut and fitted neatly and shall be reinforced with structural steel members to distribute the load.

F. Where concrete fill is required, deck shall be installed with closure plates and other accessories as needed to prevent loss of water, cement, and fines during placing and consolidation of the concrete.

G. Edges of any cut openings or any minor surface damage areas shall be repaired in accordance with applicable requirements of the Sections 09 96 00 – Protective Coating and 05 50 00 – Miscellaneous Metalwork.

H. After installation, surfaces shall be cleaned and left free of grime and dirt. The CONTRACTOR shall remove unused materials, tools, scaffolding, and debris from the premises and leave the area broom clean.

3.2 WELDING

A. Care shall be exercised in the selection of electrodes and amperage to provide positive welds and to prevent high amperage blowholes. Welds shall be made from the top side of the deck immediately after alignment.

B. The metal deck shall be welded to supporting members with 1/2-inch effective diameter puddle welds spaced at 12-inches on center at members parallel to the ribs and at every rib valley at members perpendicular to the ribs, unless otherwise indicated. Welding washers shall be used when welding steel deck of less than 0.028-inch thickness. Welding washers shall not be used when welding steel deck of 0.028-inches or greater.

C. Side laps shall be welded with 1-1/2 inch long top seam welds, spaced at 12-inches on center unless indicated otherwise.

D. Welds shall be free of sharp points or edges. Welds shall be cleaned immediately by chipping or wire brushing and shall be coated with a zinc dust type primer paint.

E. Welding shall conform to the applicable requirements of AISC "Light Gauge Steel Design." Welders shall be AWS certified.

END OF SECTION

SECTION 05 40 00 - COLD FORMED METAL FRAMING

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall construct light metal framing and appurtenant WORK, complete and in place, in accordance with the Contract Documents.

B. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

ASTM A 1011 Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

ASTM A 653 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process

ASTM C 645 Non Structural Steel Framing Members

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.

B. Product Information: Manufacturer's literature, specifications, installation instructions, technical data, and general recommendations.

C. Product Selection: Manufacturer's information for typical cross sectional properties and connection details for members selected for construction.

D. Certifications: Manufacturer's certification that the proposed materials comply with this Section.

PART 2 PRODUCTS

2.1 METAL STUDS

A. Non-Load Bearing

1. Metal studs shall be of the non-load-bearing channel type, roll-formed electrogalvanized steel. Tracks and erection accessories shall be standard products of an established metal stud manufacturer, unless otherwise indicated. Metal studs shall be 25-gauge, 3-5/8-inch deep unless otherwise indicated.

2. Eighteen-gauge studs shall be used at non-load bearing walls having a lath and plaster condition.

B. Load Bearing: Metal studs of 16-gauge steel shall be used where indicated to be used. They shall be standard 16-gauge, punched steel, galvanized studs formed from steel meeting the requirements of ASTM A 1011 with 50,000 psi.

1. Studs designed for load bearing conditions shall be:

a. Lower floor: Use 16-gauge "C", 3-5/8-inch by 1-5/8-inch.

2.2 MISCELLANEOUS MATERIALS

A. Hanger Wire: Hanger wire for suspended gypsum board ceilings shall be of soft-temper, annealed and galvanized steel wire. Hanger wire size shall be not less than that required by governing code.

B. Runner Channels: Runner channels shall be 1-1/2 inch cold-rolled channels and 3/4-inch stiffener channels, galvanized or factory-coated with rust-inhibitive paint. Channels shall have minimum weight of 475 and 300 lbs/1000 L.F. respectively.

C. Furring Channels: Furring channels shall be designed for screw attachment of 5/8-inch gypsum wallboard. They shall be roll-formed, galvanized Grade "A" steel conforming to ASTM A 653, with a metal thickness of 0.022-inch minimum, 7/8-inch depth, and 1-3/8 inch web.

D. Tie Wire: Tie wire shall be galvanized, 16-gauge, annealed steel wire.

E. Fasteners: Fasteners shall be as required and as recommended within the Reference Standards.

F. Welding Materials: Welding materials shall be as recommended in the published standards of the structural stud manufacturer.

G. Power-Driven Pins: Power-driven pins to be installed in concrete or steel shall be of heat-treated steel alloy. If the pins are not sufficiently corrosion-resistant for the conditions to which they are to be exposed, they shall be protected in an acceptable manner. Pins shall have capped or threaded heads capable of transmitting the loads the shanks are required to support. Pins that are connected to steel shall have longitudinal serrations around the circumference of the shank. Complete information describing pin capacity, connections, and proposed area of use shall be submitted to the ENGINEER.

PART 3 EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. WORK shall be installed in conformance with the manufacturer's recommendations, the applicable requirements of the governing code, ANSI standards, and as indicated.

3.2 CEILING SUSPENSION SYSTEM

A. Components: All necessary items for a complete installation shall be provided, including devices for attachment to overhead construction, hanger wires, main runners, splines, splicers, connecting clips, wall connectors, hold-down clips, edge moldings, and other appurtenances.

B. Hanger Wires: Hanger wires shall be spaced along the main runner so that each hanger supports a maximum area of 16 square feet.

C. Runner Channels: Main runners shall be 1-1/2 inch channels spaced at 4-feet on centers. Hanger wires shall be saddle-tied along runners. Cross-furring channels shall be spaced at 16-inches on centers, maximum, and shall be saddle-tied to main runner channel.

D. Interruptions: At openings that interrupt the continuity of furring channels, additional cross reinforcing shall be provided to restore lateral stability of grillage.

3.3 METAL STUDS, FURRING AND FRAMING (FOR NON-BEARING WALLS)

A. Runner Track Attachment: Floor and ceiling runner tracks shall be securely fastened to floor and overhead construction as indicated and as required.

B. Stud Attachment: Studs shall be securely fastened to tracks and spaced in accordance with the stud schedule. Each stud shall be crimped into runner tracks at the top, bottom, and both sides for friction fit with 1/4-inch deflection clearance on top.

C. Wall Stiffening: Walls shall be stiffened with 3/4-inch channels placed horizontally at not more than 4-1/2 foot vertical spacing.

D. Stud Installation Requirements

1. Studs shall be located at all door frame jambs, at abutting construction, intersecting walls, and corners. Each corner and intersection of walls and partitions shall be formed with not less than 3 studs.

2. Double 20-gauge studs shall be secured to the jamb anchors of each door frame by bolt or screw attachment. Studs at door openings shall extend to the structure.

3. Studs extending from door frame header to ceiling runner over door frames shall be positioned at wall board joints. Stud walls that do not extend to structures above the ceiling shall be braced to the structure every 8 feet.

4. The CONTRACTOR shall install 20-gauge studs at wall-mounted fixtures and at a maximum of 12-inches on centers behind walls to receive ceramic tile.

5. Stud walls shall be braced as necessary to provide rigid construction. Double row of studs for chase walls shall be braced with cross ties of 1/2-inch or 5/8-inch thick gypsum board, 12-inches wide, installed at quarter points of studs.

6. Parapet walls and hung exterior walls and soffits shall be framed as indicated with not less than 18-gauge studs.

E. Openings

1. Channels shall be provided around openings for attachment of metal frames, dampers, grilles, and ductwork in connection with metal studs and shall be securely fastened to studs.

2. Headers, sills, and jack studs shall be provided as required at openings. Headers shall overlap adjacent vertical studs and shall be securely screw-attached to adjacent studs.

3. Where 25-gauge studs are used, a 1-1/2 inch channel stiffener shall be installed 6-inches above the door openings. Stiffeners shall extend past the second single-stud on each side of the opening, and shall be saddle-tied to the structure.

F. Lintels: Trussed or box-framed lintel members designed to resist applied loads without excessive deflection shall be provided and shall be secured together by screws or other approved means.

G. Support for Wall-Mounted Braced Items: Solid blocking, 1-1/2 inch channels, horizontal studding or other members within walls shall be provided as required to provide secure and adequate support for wall-mounted or wall-braced items. Galvanized plates shall be provided as backing for handrail brackets, 16-gauge by 8-inch by 16-inch.

H. Horizontal Stiffeners: Ends of horizontal stiffeners shall be securely fastened to abutting construction.

3.4 STRUCTURAL LOAD BEARING STEEL STUD WALLS

A. Prefabrication: Structural steel stud walls may be fabricated into panels or components prior to erection.

B. Stud Spacing: Studs shall be spaced at 16-inch centers for lower floor construction, and at 16-inch centers for upper floor construction.

C. Component Attachment

1. Attachments of similar components shall be done by welding. Dissimilar stud components shall be attached by welding, screw attaching, or bolting. Welds shall be fillet, plug, butt, or seam welds.

2. Wire tying of framing components in structural applications will not be permitted and will not be acceptable.

3. Splices in axial hooded studs shall not be used.

D. Butt Joints in Tracks: Butt welds or splices shall be used at all butt joints in the tracks.

E. Stud Track Anchorage

1. Bottom track for structural steel studs shall be anchored to concrete floor or foundation slabs with 1/8-inch diameter shank power-driven fasteners at 6-inch on center.

2. Wall top and bottom tracks.

3.5 WORKMANSHIP

A. Alignment: Metal studs shall be installed rigid, in line, level, and plumb and shall be suitable for the application of the intended succeeding contiguous materials. The maximum allowable

deviation in any plane shall be 3/16-inch from an 8-foot straight line and 1/2-inch maximum in a surface having a total length in excess of 8-feet.

B. Component Fit

1. Framing components shall be cut squarely or on an angle, as in bracing, to fit squarely against abutting members.

2. Tracks shall be securely anchored to the floor and overhead structure or other members.

3. Studs shall be seated squarely in the track with the stud web and flanges abutting the track web, shall be plumbed or aligned, and shall be securely attached to the flanges or web of both the upper and lower tracks.

C. Temporary Bracing

1. Framing shall be held firmly in position until properly fastened.

2. Prefabricated panels shall be square and braced against racking. Lifting of prefabricated panels shall be done in a manner as to not cause local distortion in any member.

D. Jack Studs: Jack studs shall be provided between all track and window sills; between window and door headers and top track; at free-standing stair rails; and elsewhere to provide structural support. Jack studs shall be securely attached to supporting members.

END OF SECTION

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SECTION 05 50 00 – MISCELLANEOUS METALWORK

PART 1 GENERAL

1.1 THE SUMMARY

A. Provide miscellaneous metalwork and appurtenances, designed, complete and in place, as indicated in accordance with the Contract Documents.

B. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Federal Specifications

MIL-G-18015 A (3) (Ships) Aluminum Planks. (6063-T6)

MIL-PRF-907F Antiseize Thread Compound, High Temperature

B. Codes

OSHA 1927.10 Fixed Ladders

C. Commercial Standards

AA-M32C22A41 Aluminum Assn.

AASHTO HS-20 Design Truck Loading

AISC Manual of Steel Construction

AISI Design of Light Gauge, Cold-Formed Steel Structural Members

ASTM A 36 Carbon Structural Steel

ASTM A 48 Gray Iron Castings

ASTM A 53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 193 Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service

ASTM A 194 Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service

ASTM A 307 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

ASTM A 325 Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM A 500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A 992Steel for Structural Shapes for Use in Building Framing

ASTM F 1554 Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength

ANSI/AWS D1.1 Structural Welding Code - Steel

ANSI/AWS D1.2 Structural Welding Code - Aluminum

ANSI/AWS QC1 Qualification and Certification of Welding Inspectors

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with the requirements of Section 01 33 00 - Contractor Submittals.

B. Calculations

1. Structural calculations shall be submitted for:

a. Stair System
b. Handrails
c. Guardrails
d. Ladders
e. Grating
f. Appurtenances, connections, anchorage and supports for items listed above

2. Calculations shall be signed and sealed by a professional engineer registered in the State of Oregon and shall be submitted to the Owner and Permitting Agency. Work shall not commence on items not approved by the Owner and Permitting Agency.

C. Shop Drawings

1. Shop Drawings shall conform to AISC recommendations and specifications, and shall show holes, and the like, as may be required for other parts of the WORK.

2. Shop Drawings shall include complete details of members and connections, anchor bolt layouts, schedules for fabrication procedures, and diagrams for the sequence of erection.

D. Grating

1. Submit layout drawings for grating, showing the direction of span, type and depth of grating, size and shape of grating panels, seat angle details, and details of grating hold down fasteners.

2. Submit load and deflection tables for each style and depth of grating used.

E. Anchor Submittals

1. For post installed anchors in concrete other than powder-drive pins or impact anchors, refer to Section 05 05 19 – Post Installed Anchors in Concrete.

2. For post installed anchors in concrete masonry units other than powder-drive pins or impact anchors, refer to Section 04 05 19.29 – Post Installed Anchors in Masonry.

3. For powder-drive pins or impact anchors, complete structural calculations and anchorage details shall be prepared and submitted by the Contractor for all anchors and anchor groups that are shown but not completely detailed (type, size, location, spacing and embedment) on the Contract Documents. Calculations and anchorage details shall be signed and stamped by a Professional Engineer registered in the state in which the project is located.

1.4 QUALITY ASSURANCE

A. Weld procedures and welder qualifications shall be available in the CONTRACTOR's field office for review.

B. Welding Special Inspection shall be performed by the OWNER in accordance with the enforceable Building Code and Contract Drawings.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Steel

Wide Flange Shapes	ASTM A 992
Shapes, Plates, Bars	ASTM A 36
Pipe, Pipe Columns, Bollards	ASTM A 53, Type E or S, Grade B standard weight unless indicated otherwise
HSS	ASTM A 500 Grade B

B. Corrosion Protection

1. Unless otherwise indicated, fabricated steel metalwork which will be used in a corrosive environment and/or will be submerged in water or wastewater shall be coated in accordance with the requirements of Section 09 96 00 - Protective Coating, and shall not be galvanized prior to coating.

2. Other miscellaneous steel metalwork shall be hot-dip galvanized after fabrication.

C. Stainless Steel

1. Unless otherwise indicated, stainless steel metalwork and bolts shall be fabricated from Type 316 stainless steel.

D. Aluminum

1. Unless otherwise indicated, aluminum metalwork shall be fabricated from Alloy 6061-T6.

2. Aluminum in contact with concrete, masonry, wood, porous materials, or dissimilar metals shall have contact surfaces coated in accordance with the requirements of Section 09 96 00 - Protective Coating.

E. Cast Iron

1. Unless otherwise indicated, iron castings shall conform to the requirements of ASTM A 48, Class 50B, or better.

2.2 ALUMINUM RAILINGS

A. General

1. Aluminum handrails and railings shall be component systems, complete with anchors, attachments, balusters, brackets, caps, fasteners, gates (swing with self-latching hardware or be removable), posts, sleeves, trim, and any other related items as required or necessary for a complete installation.

2. Gates and removable rail sections shall be complete with hardware such as self-closing hinges, self-latching latches, hasps, and the like.

3. Railings shall conform to Building Code and OSHA requirements, General Industry Occupational Safety and Health Standards (29CFR1910).

B. Design Criteria

1. Railing shall be designed for a minimum 200 pound concentrated load and a minimum 50 pound per foot uniform load (not concurrently) applied in any direction and at any point on the handrail or top rail to produce the maximum load effect on the element being considered.

2. The attachment of the railing and any supporting members shall be designed to support the above loading.

C. Materials shall conform to the following requirements:

1. Aluminum

a. Aluminum shall be U.S. Alloy 6063 T-5 or T-6.
b. Aluminum pipe rail shall not be less than 1-1/2-inch diameter Schedule 40 pipe.

2. Electrolysis protective material shall be in accordance with the requirements of Section 09 96 00 - Protective Coating.

3. Sleeves shall be of galvanized steel or PVC.

4. Grout for handrail posts shall consist of an inorganic, non-shrink, non-metallic premixed grout in accordance with the requirements of Section 03 60 00 - Grouting, with a minimum 28-Day compressive strength of 4,000 psi.

5. Fasteners, screws, and bolts shall be concealed and shall be fabricated from stainless steel or aluminum.

6. Aluminum welding rods shall be of a type recommended by the aluminum manufacturer for anodized finished products.

7. Kickplates shall be provided on railings and not set in curbs.

D. Pipe railing systems, including handrails, railings, tube caps, and other miscellaneous parts of the rails, shall be provided with a clear anodized finish, AA-M32C22A41.

E. Manufacturers or Equal

1. C-V Pipe Rail by Crane Veyor Corp.
2. Connectorail by Julius Blum and Co.

2.3 METAL STAIRS

A. Metal Stairs

1. Metal stairs shall be composed of steel or aluminum stringers and supports, shall be fabricated in accordance with the standard practice of the National Association of Ornamental Metal Manufacturers, and shall be as indicated.

2. Design Criteria

a. Stairs shall support uniform and concentrated live loads transferred from the grating treads, handrailing and guardrailing.

2.4 GRATING STAIR TREADS

A. Design Criteria:

1. Grating stair treads shall be designed to support a live load of 100 psf or a concentrated load at mid-span of 300 pounds, whichever creates the higher stress.

2. The maximum deflection due to the uniform live load shall be as required for metal grating, below.

B. Grating stair treads shall be provided with an integral non-slip nosing.

2.5 SAFETY STAIR NOSINGS

A. Safety stair nosing shall be provided on concrete stairs and other locations as indicated.

B. The nosing shall be 3 inches wide and fabricated from extruded aluminum with cast-in abrasive strips and integral extruded anchors.

C. The color of the cast abrasive shall be as selected by the ENGINEER from among the manufacturer's standard colors.

D. The nosing shall be Amstep Products Style 231-A, Grating Pacific XRS-3, Robertson Grating Products Type 9511, or equal.

2.6 LADDERS

A. Materials

1. Ladders which may be partially or wholly submerged or which are located inside a hydraulic structure shall be fabricated entirely of Type 316 stainless steel.

2. Other ladders shall be fabricated from materials as indicated.

B. Fixed Step-Through Ladders shall be equipped with grab bar extensions meeting OSHA requirements.

1. Approved products include **Model 504 Access Ladder** by **O'Keefe's**, or equal. Grab bars by **CAI Safety Systems** may be added to other existing or new ladders.

C. Fall Prevention System (Ladder Safety System)

1. The fall prevention system at ladders shall include top and bottom brackets, ladder rung clamps, a steel cable that runs the height of the ladder, sleeves and full body harness (one per ladder), dismount section, and other components as necessary for a complete system.

2. All requirements of OSHA 1910.29 must be met.

3. The system shall be stainless steel unless noted otherwise. When steel ladders are specified, the ladder safety system is permitted to be galvanized steel.

4. Approved products include **Lad-Saf** by **DBI Sala**, or equal.

D. Pop-Up Extension

1. Every ladder that does not extend above the access level shall be equipped with a pop-up ladder extension.

2. The pop-up ladder extension device shall be manufactured of the same material and finish as the ladder, and shall be provided with a telescoping tubular section that locks automatically when fully extended.

3. Upward and downward movement shall be controlled by stainless steel spring balancing mechanisms.

4. The units shall be completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturer's instructions.

2.7 METAL GRATING

A. General

1. Metal grating shall be of the indicated design, size, and type.

2. Where the grating depth is not indicated, provide grating within allowable stress levels and which shall not exceed a deflection of 1/4 inch or the span divided by 180, whichever is less, when loaded with the design loading listed below.

3. Grating shall be supported around an opening by support members.

4. Where grating is supported on concrete, unless otherwise indicated provide embedded support angles that match the grating material and are mitered and welded at their corners.

5. Banding

    a. The grating shall be completely banded at edges and cutouts.
    b. The banding material and cross-section shall be equivalent to the bearing bars.
    c. The banding shall be welded to each cut bearing bar.

6. The grating pieces shall be fastened to each support in 2 locations.

7. Where grating forms the landing at the top of a stairway, the edge of the grating that forms the top riser shall have an integral non-slip nosing with a width equal to that of the stairway.

8. Design Loading

    a. For standard duty plank and safety grating, the loading to be used for determining stresses and deflections shall be the uniform live load of the adjacent floor or 100 psf, whichever is greater, or a concentrated load of 1000 pounds.

    b. For heavy duty grating, the loading used for determining stresses and deflections shall be in accordance with AASHTO HS-20.

B. Material

1. Except where indicated otherwise, bar grating shall be fabricated entirely of:

    a. aluminum

        1) Bearing and Banding Bars: Alloy 6061-T6
        2) Cross Bars: Alloy 6063-T5

2. Safety grating shall be fabricated from aluminum alloy 5052-H32.

3. Plank grating shall be fabricated from aluminum alloy 6063-T6.

4. Grating that may be partially or wholly submerged shall be fabricated entirely of Type 316 stainless steel

C. Standard-Duty Grating

1. No single piece of grating shall weigh more than 80 pounds, unless indicated otherwise.

2. Standard duty grating shall be composed of serrated bar grating.

3. Cross bars shall be welded or mechanically locked tightly into position such that there is no movement between the bearing and cross bars.

D. Safety Grating

1. Safety grating shall be fabricated from sheet metal punched into an open serrated diamond pattern and be formed into plank sections.

2. The open diamond shapes shall be approximately 1-7/8 inches by 11/16-inch in size.

3. Safety grating shall be Grip Strut by Metal Products Division, United States Gypsum Company, Deck Span by IKG Industries, or equal.

E. Heavy-Duty Grating

1. Heavy-duty grating shall be fabricated from welded steel, galvanized after fabrication.
2. Crossbars shall be welded in position.

F. Plank Grating

1. Plank grating shall be extruded in 6-inch widths with a minimum of 6 integral one-bar type bearing bars per plank.

2. The top surface shall be solid with raised ribs, unless indicated otherwise.

3. Where punched grating is required, the top surface shall be provided with a pattern of 3-inch by 19/32-inch rectangular openings spaced at 4 inches on-center.

4. The planks shall have a continuous tongue-and-groove type interlock at each side, except that interlocking planks shall be arranged such that any 4-foot wide section may be removed independently from the other grating sections.

2.8 FALL PREVENTION SYSTEM

A. The fall protection system at each ladder shall include a carrier rung, ladder ring clamps, sleeves and full body harnesses, dismount section, and other components as necessary for a complete system.

B. The carrier rail shall be fabricated from the same material as the ladder, except for fiberglass ladders, which shall be provided with stainless steel carrier, rails, and shall be the length recommended by the manufacturer for the ladder dimensions, including extensions.

C. The fall protection system shall be 2000 Climb Rite by Sellstrom Manufacturing Company, Saf-T-Climb by North Safety Products Ltd., or equal.

2.9 BOLTS AND ANCHORS

A. Standard Service (Non-Corrosive Application)

1. Bolts, anchor rods, anchor bolts, washers, and nuts shall be fabricated from steel as indicated.

2. Threads on galvanized bolts, rods and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing.

3. Except as otherwise indicated, steel for bolt material, anchor rods, anchor bolts, and cap screws shall be in accordance with the following requirements:

a. Structural Connections: ASTM A 307, Grade A or B, hot-dip galvanized

b. Headed Anchor Rods and Anchor Bolts: ASTM F1554, Grade 36, hot-dip or mechanically galvanized with Grade A matching nuts

c. High-Strength Bolts, where indicated: ASTM A 325

d. Pipe and Equipment Flange Bolts: ASTM A 193, Grade B-7

B. Corrosive Service

1. Bolts, anchor rods, anchor bolts, nuts, and washers in the locations listed below shall be fabricated from stainless steel as indicated.

a. buried locations

b. submerged locations

c. locations subject to seasonal or occasional flooding

d. inside hydraulic structures below the top of the structure

e. inside buried vaults, manholes, and structures that do not drain through a gravity sewer or to a sump with a pump

f. chemical handling areas

g. inside trenches, containment walls, and curbed areas

h. locations indicated or designated by the ENGINEER to be provided with stainless steel bolts

C. Unless otherwise indicated, stainless steel bolts, nuts, anchor rods, and washers shall be fabricated from Type 316 stainless steel, Class 2, conforming to ASTM A 193 for bolts and to ASTM A 194 for nuts.

D. Buried pipe flange bolts and nuts on pipe of Class 275 and greater shall be in accordance with ASTM A193/A194, Grade B7.

E. Coating

1. Threads on stainless steel bolts and rods shall be protected with an antiseize lubricant suitable for submerged stainless steel bolts, meeting government specification MIL-A-907E.

2. Buried bolts in poorly drained soil shall be coated the same as the buried pipe.

3. Antiseize lubricant shall be classified as acceptable for potable water use by the NSF.

4. Antiseize lubricant shall be "PURE WHITE" by **Anti-Seize Technology,** Franklin Park, IL, 60131, **AS-470** by **Dixon Ticonderoga Company,** Lakehurst, NJ, 08733, or equal.

F. Bolt Requirements

1. The bolt and nut material shall be free-cutting steel.

2. The nuts shall be capable of developing the full strength of the bolts.

3. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads.

4. Bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

5. Bolts and nuts shall be installed with washers fabricated from material matching the base material of bolts, except that hardened washers for high-strength bolts shall conform to the requirements of the AISC Specification.

6. Lock washers fabricated from material matching the bolts shall be installed where indicated.

7. The length of each bolt shall be such that the bolt extends at least 1/8 inch beyond the outside face of the nut before tightening, except for anchor bolts which shall be flush with the face of the nut before tightening.

2.10 POWDER-DRIVEN PINS

A. Powder-driven pins for installation in concrete or steel shall be fabricated from heat-treated steel alloy.

B. If the pins are not inherently sufficiently corrosion-resistant for the conditions to which they will be exposed, they shall be protected in an acceptable manner.

C. Pins shall have capped or threaded heads capable of transmitting the loads the shanks are required to support.

D. Pins that are connected to steel shall be provided with longitudinal serrations around the circumference of the shank.

2.11 IMPACT ANCHOR

A. Impact anchors shall be an expansion-type anchor in which a nail-type pin is driven to produce the expansive force.

B. The pin shall be provided with a zinc sleeve with a mushroom-style head and stainless steel nail pin.

C. Anchors shall be Zinc Nailon Anchors, manufactured by Simpson Strong-Tie, Inc., Metal Hit Anchors, manufactured by Hilti, Inc., Rawl Zamac Nailin, manufactured by the Rawlplug Company, or equal.

PART 3 EXECUTION

3.1 FABRICATION AND INSTALLATION REQUIREMENTS

A. **Fabrication and Erection:** Except as otherwise indicated, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."

B. Aluminum Railings

1. Aluminum railing fabrication and installation shall be performed by craftsmen experienced in the fabrication of architectural metalwork.

2. Exposed surfaces shall be free from defects or other surface blemishes.

3. Dimensions and conditions shall be verified in the field.

4. Joints, junctions, miters, and butting sections shall be precision fitted with no gaps occurring between sections, and with surfaces flush and aligned.

5. Electrolysis protection of materials shall be provided.

C. Steel Railings: Field welding of steel pipe handrail joints will be permitted only if approved by the ENGINEER, and then only in accordance with the ENGINEER's instructions.

D. Unless otherwise indicated, provide a 1/2-inch drain line to the nearest floor drain for floor hatches.

E. Powder-Driven Pins

1. Powder-driven pins shall be installed by a craftsperson certified by the manufacturer as being qualified to install the manufacturer's pins.

2. Pins shall be driven in one initial movement by an instantaneous force that has been carefully selected to attain the required penetration.

3. Driven pins shall conform to the following requirements where "D" is equal to the pin shank diameter:

Material Penetrated by Pin	Material Minimum Thickness	Pin Shank Penetration in Supporting Material	Minimum Space From Pin's CL to Edge of Penetrated Material	Minimum Pin Spacing
Concrete	16D	6D minimum	14D	20D
Steel	1/4-inch	Steel thickness	4D	7D

3.2 WELDING

A. Method

1. Welding shall be performed by the metal-arc method or gas-shielded arc method as described in the American Welding Society "Welding Handbook" as supplemented by other pertinent standards of the AWS.

2. The qualification of the welders shall be in accordance with the AWS Standards.

B. Quality

1. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained in order to minimize distortion and for control of dimensions.

2. Weld reinforcement shall be as indicated by the AWS Code.

3. Upon completion of welding, remove weld splatter, flux, slag, and burrs left by attachments.

4. Welds shall be repaired in order to produce a workmanlike appearance, with uniform weld contours and dimensions.

5. Sharp corners of material that is to be painted or coated shall be ground to a minimum of 1/32 inch on the flat.

3.3 GALVANIZING

A. Structural steel plates shapes, bars, and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the requirements of ASTM A 123.

B. Any galvanized part that becomes warped during the galvanizing operation shall be straightened.

C. Bolts, anchor rods, anchor bolts, nuts, and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A 153.

D. Field Repairs

1. Field repairs to damaged galvanizing shall be performed by preparing the surface and applying a coating.

2. Surface preparation shall consist of removing oil, grease, soil, and soluble material by cleaning with water and detergent (SSPC SP1) followed by brush-off blast cleaning (SSPC SP7) over an area extending at least 4 inches into the undamaged area.

3. The coating shall be applied to at least 3 mils dry film thickness, and shall be **Zinc-Clad XI** by **Sherwin-Williams**, **Galvax** by **Alvin Products**, **Galvite** by **ZRC Worldwide**, or equal.

3.4 FALL PREVENTION SYSTEM

A. A fall prevention system shall be provided on ladders used to ascend heights exceeding 20 feet.

END OF SECTION

SECTION 06 20 00 – FINISH CARPENTRY

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide finish carpentry and appurtenant WORK, complete, in place, and operational in accordance with the Contract Documents.

B. The CONTRACTOR shall coordinate color samples with other Sections through the submittal process, as required by the ENGINEER.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. Architectural Woodwork Quality Standards Illustrated (AWI).

C. American Society of Testing and Materials (ASTM):

ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

D. Building Code: Refer to the Drawings to determine which building code applies. The applicable building code, defined by the Drawings, is referred to herein as “the CODE.”

E. Commercial Standard: CS 236-66.

F. National Electrical Manufacturers Association (NEMA):

NEMA LD3 High Pressure Decorative Laminates

1.3 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Literature: Manufacturer’s specifications, technical data, installation methods, and maintenance instructions, and the following:

1. Manufacturer’s color charts for color selection by the OWNER.

C. Warranty: Submit a copy of the warranty.

D. Certifications:

1. Certification by the finish carpentry Manufacturer that the finish carpentry materials are suitable for, and compatible with, the required installation.

2. Certification that the finish carpentry provided complies with the requirements indicated.

3. Certification of Manufacturer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with

addresses of the project location, date of project completion, Manufacturer's products, and contact information of the consultant firm of record, general contractor and OWNER.

4. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, and contact information of the consultant firm of record, general contractor and OWNER.

5. When requested by the ENGINEER, furnish other certifications as may be required to demonstrate compliance with the Contract Documents.

E. Shop Drawings: Complete Shop Drawings showing location and detail of installation.

1. Shop Drawings shall be drawn to sufficient scale and shall include dimensions, show elevations and details of construction of each casework countertop, and cabinet type, location and installation requirements for hardware, thickness of materials, joints, provisions for expansion and contraction, connections, accessories, and trim.

2. Shop Drawings shall show installation conditions at adjacent construction, and shall include indications for anchorage devices, blocking, backing, and reinforcement built into other WORK for securing finish carpentry.

F. Samples: The CONTRACTOR shall submit 2 Samples of each of the following. Unless otherwise indicated, samples shall be full size and shall show thicknesses, configuration, construction, finish and color proposed for the various components. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by the ENGINEER. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the CONTRACTOR from compliance with the Contract Documents.

1. Manufacturer's plastic laminate color samples.

2. Counter construction – Plastic laminate surface on both sides with required edge condition and backsplash, full counter thickness by 12-inches (305 mm) by 12-inches (305 mm).

3. Cabinet casework – Plastic laminate on both sides of a jointed bottom and side Section and a door Section hinged to side showing flush overlay. Provide a 12-inch (305 mm) cube section.

4. Cabinet casework hardware – submit samples of all hardware components.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Cabinet, countertop, and casework shall be provided from a single Manufacturer.

B. Manufacturer Qualifications:

1. Cabinet, countertop, and casework Manufacturer shall have a minimum of 20 years of cabinet, countertop, and casework manufacturing experience.

2. Cabinet, countertop, and casework manufacturer shall have a minimum of 5 similar successful projects over the most recent 10 years, employing similar products, materials, applications, and performance requirements.

3. Manufacturers without these qualifications will not be accepted.

C. Installer Qualifications:

1. A minimum of 5 years' experience in the successful completion of at least 5 projects of similar size and scope, employing similar products, materials, applications, and performance requirements.

2. Installers without these qualifications will not be accepted.

D. For finish carpentry items, comply with the specified provisions of the "Architectural Woodwork Quality Standards Illustrated" of the AWI Premium Grade Standards.

1.5 SPECIAL WARRANTY PROVISIONS

A. Furnish manufacturer's 5-year written warranty to cover defects in materials, products and manufacturing workmanship.

B. The CONTRACTOR shall furnish separate, but concurrently running, 5-year written warranty to cover labor.

C. Warranties shall be non-prorated for the entire warranty period.

D. The term of the warranties shall begin on the date of substantial completion.

PART 2 PRODUCTS

2.1 CABINET, COUNTERTOP, AND CASEWORK CORE MATERIAL

A. Description: Core material for plastic laminate WORK shall be 45-lb (20.4 kg) density, industrial grade particle board conforming to Commercial Standard CS 236-66: Type 1, Grade B, Class 2, and 3/4-inch (19 mm) minimum thickness as recommended in writing by the laminate Manufacturer.

2.2 PLASTIC LAMINATE

A. Manufacturer and Product, or Equal:

1. Subject to the requirements herein, provide products from one of the Manufacturers listed below, or equal.

a. Formica High Pressure Plastic Laminates
b. Wilsonart International Plastic Laminates

B. Description:

1. Plastic laminate shall comply with NEMA Publication LD3 for general purpose type 0.050-inch (1.3 mm) minimum thickness for exposed WORK and 0.020-inch (.51 mm) minimum thickness for back-up sheets as required.

2. Finish shall be matte texture.

3. Performance Standards:

ASTM E 84	Flame Spread: 25 or less Smoke Developed: 450 or less

C. Color shall be selected and approved by the OWNER from the Manufacturer's full color range.

1. Tentative color selection: Provide for 3 color choices to be selected.

2. The OWNER reserves the option of changing this tentative color selection during the submittal process.

2.3 CABINET HARDWARE

A. Manufacturer, or Equal:

1. Subject to the requirements herein, provide products from the Manufacturer listed below, or equal.

a. Sugatsune America, Inc.

B. Description:

1. Door and drawer pulls shall be Type 316 stainless steel, satin finish, with stainless steel screws, Sugatsune America Model No. SWF-650.

2. Stainless steel hinges, spring loaded, European Style, for 3/4-inch (19 mm) thick overlay doors, Sugatsune America Model No. 436-C46/19.

C. All drawers shall have medium duty side-mounted, cold rolled steel, zinc plated roller slides with ball bearings, by **Grass America, Inc**., or equal.

D. Shelf standards for cabinets shall be chrome plated steel, end-of-shelf supports with integral doweled ends to fit drilled holes in cabinet sides.

E. Countertop Grommet Assemblies for Wiring – **Dar/Ran** or equal, 1 3/4-inch (44.5 mm) diameter cast metal caps with 1/2-inch (13 mm) wide wire space and caps locking into body of grommet, also in metal. Assemblies shall be flush with tops.

1. Provide in color selected by the OWNER.

2.4 FABRICATION

A. The CONTRACTOR shall field verify size, location, and placement of finish carpentry, shall advise the ENGINEER in writing of any necessary adjustments, and shall make the necessary adjustments prior to fabrication. The CONTRACTOR shall coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments.

B. Finish carpentry shall be fabricated to be rigid, neat in appearance, and free from defects, including warping, cupping, or other defects. Finish carpentry shall be accurately manufactured to required sizes and profiles.

C. Plastic laminate WORK and components shall comply with AWI Section 400, Premium Grade. Provide laminate on cabinet interiors, on both sides of exposed shelves, and other exposed WORK. Provide plastic self-edges. Provide balancing and backup sheets as required in AWI Section 400, Premium Grade.

D. Finish Carpentry shall be fabricated to conform to the intent of the elevations, sections, and details shown.

E. Cabinet casework shall be flush overlay design.

F. Finished WORK shall be dressed and sanded, free from machine and tool marks, abrasions, raised grain, or other defects on surfaces exposed to view.

G. Optimum Moisture Content for shop and site fabricated WORK shall be as follows: Kiln dry solid wood to the average moisture content of 8 percent as recommended by AWI Section 100 G-3. Maintain optimum moisture content until final finish has been applied.

H. WORK shall be continuous in lengths for the size of finish carpentry indicated. No splicing will be allowed.

I. Install cabinet hardware where indicated or as required for a complete installation.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

1. Secure loose components from damage during delivery. If such items are to be delivered separately from main body of casework, wrap each piece separately to protect finish and clearly mark to show proper location in completed casework.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after installation.

B. Protect surrounding WORK from damage that may result from operations under this Section.

3.3 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where finish carpentry will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed finish carpentry.

2. The CONTRACTOR shall notify in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate CONTRACTOR's acceptance of the substrate, areas, and conditions.

3.4 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with references, with the requirements of the CODE, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the ENGINEER.

B. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

C. The CONTRACTOR shall provide corrosion resistant fasteners, anchors, and shims required for a complete installation, and shall be secure, plumb, level, straight, and true to line, with no distortions and allowing for required movement, including expansion and contraction.

D. The CONTRACTOR shall provide separation of dissimilar materials to ensure no galvanic action occurs.

E. Install finish carpentry in a manner consistent with quality of specified Grade.

F. Shim and secure to structure with concealed shims and fasteners as required for complete installation. Scribe and cut for accurate fit to other WORK as required.

3.5 CLEANING, FINISHING, AND PROTECTION

A. Adhesive papers used for masking, which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of the CONTRACTOR.

2. Residue shall not be left on any surfaces.

B. Upon completion of the installation, finish carpentry and appurtenances shall be cleaned of dirt and other foreign matter to the satisfaction of the ENGINEER.

1. Cleaning shall be performed again immediately prior to acceptance of the WORK, as determined by the ENGINEER.

2. Cleaning shall be performed in accordance with the Manufacturer's written instructions.

C. Adjusting and cleaning shall consist of ensuring smooth operation, lubricating and testing the cabinet doors, drawers, and other moving parts.

1. Moving parts shall operate smoothly, quietly, and without squeaking and binding.

2. The CONTRACTOR shall make adjustments required and retest until accepted.

D. Finish carpentry shall be protected from damage from subsequent construction operations.

E. The CONTRACTOR shall remove scratches and blemishes to the satisfaction of the ENGINEER.

F. Damaged or defective items shall be removed and replaced at the direction of the ENGINEER.

1. Remove and replace defective WORK, including finish carpentry that is warped, bowed, or otherwise unacceptable.

G. When finish carpentry WORK is completed, remove unused materials, containers, and equipment, and clean the Site of finish carpentry debris.

END OF SECTION

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SECTION 06 80 00 - FIBER GLASS REINFORCED PLASTIC FABRICATIONS

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide fabricated fiberglass reinforced plastic (FRP) items, complete and in place, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals

B. Calculations

1. Structural calculations shall be submitted for:

   a. Ladders
   b. Grating
   c. Raised Floor Grating System
   d. Appurtenances, connections, anchorage and supports for items listed above

2. Calculations shall be signed and sealed by a professional engineer registered in the State of Oregon and shall be submitted to the Owner and Permitting Agency. Work shall not commence on items until approved by both the Owner and Permitting Agency.

C. Shop Drawings

1. Shop Drawings for every FRP item. Include plans, elevations, and profiles that clearly show material sizes, types, styles, part or catalog numbers. Drawings shall include complete details for the fabrication and erection of components, including location, dimensions, lengths, joining method, type and size of fasteners, clip angles, member sizes, and connection details.

D. Grating Layout Drawings

1. Layout drawings shall show the direction of span, type and depth of grating, size and shape of grating panels, seat angle details, and details of grating hold down fasteners.

E. Product Literature

1. Manufacturer's published literature including structural design data, structural properties, and load and deflection tables for each style and depth of grating, corrosion resistance tables, certificates of compliance, test reports (as applicable), anchoring system allowable load tables and ICBO reports.

F. Samples

1. Samples of each type of product shall be submitted if requested by the ENGINEER.

G. Certification

1. The CONTRACTOR shall certify on the Shop Drawings that items and fabrications have been manufactured of materials suitable for potable water usage per NSF 61, and that fabricated items are of sufficient strength to serve their intended function without undue distortion or deflection.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Items provided under this Section shall be furnished only by manufacturers having experience in the manufacture of similar products, with a record of 5 similar successful installations in the last 5 years.

B. Quality: Fiberglass items shall be constructed of new, first-class, commercial-quality, fiberglass fabric-reinforced polyester or vinyl ester resin laminate material of the strength, thickness, and dimensions indicated, using the matched die-molded method.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. FRP items shall be composed of fiberglass reinforcement and resin in quantities, qualities, properties, arrangements, and dimensions as necessary to meet the design requirements and dimensions indicated.

B. Fiberglass reinforcement shall be continuous roving, continuous strand mat, and surfacing veil or a combination thereof in sufficient quantities for the application and physical properties required.

C. Unless indicated otherwise, resin shall be fire retardant isophthalic polyester or vinyl ester with chemical formulation as necessary to provide the corrosion resistance, strength, and other physical properties as required. FRP items used in chemical storage or containment areas shall be vinyl ester resin, with chemical formulations as necessary to provide the corrosion resistance, strength, and other physical properties required in those areas.

D. Finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids, and without dry spots, cracks, crazes, or unreinforced areas. Glass fibers shall be well covered with resin to protect against exposure from wear or weathering.

E. Resin shall include an ultraviolet (UV) inhibitor additive. FRP products located in exterior locations exposed to the weather or in UV facilities shall also have an additional 1-mil UV-resistant coating applied.

F. FRP products shall have a tested flame spread rating of 25 or less per ASTM E 84 - Surface Burning Characteristics of Building Materials. Gratings and stair treads shall also meet the self-extinguishing requirements of ASTM D 635 - Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

G. Supports and Fasteners: The CONTRACTOR shall provide bolts, anchor bolts, nuts, washers, and supports as required for the WORK of this Section in accordance with the requirements of

the manufacturers of the items. Bolts, anchor bolts, washers, and supports shall be Type 316 stainless steel. Concrete anchor systems shall be in accordance with Section 05 50 00 – Miscellaneous Metalwork.

H. Cut or machined edges, holes, scratches, gouges, and abrasions shall be sealed with a resin compatible with the resin matrix used in the original item.

2.2 FIBERGLASS GRATING

A. General

1. Seat Angles: Where grating is supported on concrete members, continuous embedded seat angles shall be provided on all sides. Grating seat angles shall be made of FRP and be as detailed on the Drawings; except that specially manufactured pultruded FRP seat angles intended to be cast in concrete may be submitted for acceptance by the ENGINEER.

2. Raised Floor Grating: Wherever raised floor grating is indicated, provide a complete system of FRP grating, FRP grating pedestals, seat angles, fastening devices, and other accessories necessary for a complete installation. Grating and supports shall be designed to fit together tightly with no movement when subjected to the design loading. The support legs and grating shall be produced by the same manufacturer and be intended to work together as a unit. The spacing of the legs shall be determined so as not to interfere with piping and equipment and to meet the requirements indicated herein.

3. Load/Deflection Requirements: Grating shall be capable of spanning the distances indicated with a minimum safety factor of 3 for stresses and without exceeding a deflection equal to the lesser of 1/4-inch or the span divided by 180. The loading used for determining stresses and deflections shall be the uniform live load of the adjacent floor area or 100 pounds per square foot, whichever is greater, or a concentrated load of 1000 pounds at the center of the span, unless otherwise indicated.

4. The top surface of grating shall be provided with a non-slip surface by embedding or bonding grit to the FRP.

5. Penetrations: Cutouts shall be provided were needed for penetrations through the grating. The grating shall be reinforced where necessary to meet the load/deflection requirements despite the cutouts.

6. Dimensional Requirements: When grating is designed to span primarily in one direction, the grating shall be fabricated to span in the shorter span direction, unless indicated otherwise. Individual pieces of grating shall not exceed 80 pounds in weight, unless indicated otherwise.

7. Mechanical grating clips shall be manufactured of Type 316 stainless steel. Grating hold-down clips shall be provided, spaced at a maximum of 4-feet apart or as recommended by the manufacturer, whichever is less. A minimum of 4 clips per piece of grating is required.

2.3 MOLDED FRP GRATING

A. Molded FRP grating shall be of a one piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane. Grating shall have a square mesh pattern.

B. Gratings shall be reinforced with continuous rovings of equal number of layers in each direction to provide bidirectional load bearing.

C. Non-slip surfacing: Grating shall have a concave profile or grit on the top of each bar for maximum slip resistance.

D. Molded FRP grating shall be Fibergrate by Fibergrate Composite Structures, Inc., Corgrate Molded Fiberglass Grating by IKG Industries, Duragrate by Strongwell; or equal.

2.4 PULTRUDED FRP GRATING

A. Pultruded FRP grating shall be fabricated from bearing bars and cross rods manufactured by the pultrusion process. The glass fiber reinforcement for the bearing bars shall have a core of continuous glass strand rovings wrapped with a continuous strand glass mat. The outermost layer covering shall be a surface veil to provide a resin-rich surface. Bearing bars shall be interlocked and chemically bonded into place to provide a panel that resists twist forces and prevents internal movement of the bearing bars.

B. Pultruded FRP grating shall be Safe-T-Span by Fibergrate Composite Structures, Inc.; Corgrate by IKG Industries; Duradek by Strongwell; or equal

2.5 SOLID FRP GRATING

A. Where solid fiberglass grating is indicated, it shall provide a continuous, solid surface and shall meet the requirements for FRP grating except as modified herein.

B. The FRP plate shall be designed to span with integral stiffening elements or may be cast with or continuously bonded to FRP grating to act as a unit to carry the required loads.

C. Hold-down fasteners shall be countersunk screws or otherwise detailed so as to be flush with the top surface. Where countersunk screws are used, the minimum plate thickness at the screw shall be 3/8-inch.

D. Fiberglass grating shall be by Strongwell, Fibergrate Composite Structures, IKG Industries, or equal.

2.6 LADDERS AND CAGES

A. Ladder side rails, rungs, ladder mounting brackets, and cage straps shall be FRP structural shapes manufactured by the pultrusion process. The minimum mechanical properties for structural shapes used in ladders and cages shall be as required for structural shapes below. Cage hoops and brackets shall be produced by the open molded hand lay-up method.

B. Wall brackets connecting the ladder to the wall shall be spaced at a maximum of 6-feet on centers.

C. Rungs shall penetrate the wall of the tube side rails and shall be connected to the rails with both chemical and mechanical fastenings.

D. Non-slip surfacing: Ladder rungs shall be provided with either continuous flutes around the rung or a quartz grit integrally molded into the top surface of the rung.

E. Color: Ladder and cage components shall be integrally pigmented yellow. Wall and floor mount brackets shall be gray.

F. Loading Criterion: The completed ladder and cage installation shall meet the load requirements as set forth in OSHA 1910 (latest edition) with a minimum factor of safety on loading of 2.0. The ladder shall also be capable of supporting an ultimate concentrated vertical load of 1,200 pounds applied at the mid-span of the rung. The ladder manufacturer shall be required to provide supporting test data for rung capacity.

G. FRP ladders and cages shall be Dynarail Ladders by Fibergrate Composite Structures, Inc., FRP Ladders by IKG Industries, Safrail Ladder and Cages by Strongwell, or equal.

2.7 STRUCTURAL SHAPES

A. Structural shapes shall be manufactured by the pultrusion process and have a maximum of 55 percent and a minimum of 45 percent glass content (by weight).

B. Pultruded structural shapes are to have the minimum longitudinal mechanical properties listed below:

Property	ASTM Method	Minimum Value	Units
Tensile Stress (Lengthwise)	D 638	30,000	psi
Tensile Modulus (Lengthwise)	D 638	2.5×10^{6}	psi
Flexural Stress (Lengthwise)	D 790	30,000	psi
Flexural Modulus (Lengthwise)	D 790	1.6×10^{6}	psi
Short Beam Shear (Lengthwise)	D 2344	4,500	psi
Shear Modulus (Lengthwise)	N/A	4.2×10^{5}	psi
Coefficient of Thermal Expansion (Lengthwise)	D 696	4.4×10^{-6}	in/in/°F

C. FRP structural shapes shall be Dynaform Fiberglass Structural Shapes by Fibergrate Composite Structures, Inc, Extren by Strongwell, CorLight by IKG Fiberglass Systems, or equal.

PART 3 EXECUTION

3.1 PRODUCT DELIVERY AND STORAGE

A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins, catalysts, and hardeners shall be crated or boxed separately.

B. Storage of Products: Materials shall be carefully handled to protect them from abrasion, cracking, chipping, twisting, deformations, and other types of damage. Store items in an enclosed area and free from contact with soil and water. Store adhesives, resins, catalysts, and hardeners in dry indoor storage facilities between 70 and 85 degrees F (21 to 29 degrees C). There shall be labels on the outside of the boxes indicating that the products shall be stored as described above.

3.2 GENERAL

A. FRP products shall meet the dimensional requirements and tolerances indicated. The CONTRACTOR shall verify measurements and determine correct size and locations of required holes or cutouts from field dimensions before fabrication.

B. FRP products shall be fabricated free from warps, twists, or other defects that affect appearance and serviceability.

C. The CONTRACTOR shall give ample notice prior to the beginning of any fabrication work so that the ENGINEER can perform shop inspections.

D. The CONTRACTOR shall install FRP structures in accordance with the manufacturer's assembly drawings. Field cut and drill FRP products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products.

E. Bonding of FRP items shall be through the use of an epoxy adhesive recommended by the manufacturer of the particular item. The surfaces to be bonded shall be solvent cleaned and abraded sufficiently to remove the surface gloss and to remove any mold release agent or other contaminants which may interfere with proper bonding. The adhesive manufacturer's instructions and recommendations shall be followed. The items bonded shall not be stressed until at least 48 hours have passed.

3.3 GRATING

A. Layout: Each grating section shall be readily removable except where indicated. As much as possible, manufacturer shall provide openings and holes where indicated on the Contract Drawings. Grating openings which fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable.

1. Install the grating with a minimum 1.5-inch bearing surface at the support ends.

2. Tolerances between sections shall provide for not more than 1/4-inch clearance between adjacent sections or between grating and frames. Adjacent sections shall line up to form an uninterrupted straight line where possible.

3. The grating shall be as free, as commercially possible from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles, and pits. The surface shall have a smooth finish (except for non-slip surfaces).

4. Seat angles shall be mitered and bonded at corners to produce smooth, even, level seating surface.

5. Grating shall be installed so that the top surface is level and even with adjacent walking surfaces. There shall be no protrusions above the top surface.

6. Grating shall be fastened to supports.

3.4 LADDERS AND CAGES

A. Ladders shall be fully shop assembled. Ladder cages shall be test assembled and drilled to ensure a proper fit in the field. Ladder cage brackets shall remain attached to the ladder for shipping, but ladder cage components can be disassembled, packaged, and shipped separately to prevent damage in transit. Cage components shall be bundled with each respective ladder.

B. Gates and Removable Sections

1. Gates shall be provided with self-closing hinges and self-closing latch bolts. Removable handrail sections shall be provided where indicated. The gate and removable railing hardware color shall match that of the railing system of which it is a part.

2. Railing posts installed into sleeves shall be provided with weep holes for condensation drainage.

3.5 STRUCTURAL SHAPES

A. Measurement: The CONTRACTOR shall verify dimensions, making any field measurements necessary, and shall be fully responsible for accuracy and layout of WORK. The CONTRACTOR shall review the Drawings, and any discrepancies shall be reported to the ENGINEER for clarification prior to starting fabrication.

B. Fabrication

1. Structural FRP shall be fabricated in accordance with the Drawings and as indicated on the Shop Drawings.

2. Materials shall be properly marked and match-marked for field assembly.

3. Where finishing is required, assembly shall be completed including bolting before starting of finishing operations.

C. Connections: Shop and field connections shall be bonded and bolted as indicated. Unless indicated otherwise, connections shall develop full strength of members joined.

D. Holes for other WORK: Holes shall be provided as necessary or as indicated for securing other WORK to FRP framing, and for the passage of other WORK through FRP members. Threaded nuts shall be epoxied to framing, and other specialty items as indicated to receive other WORK. Field cuts and drilled edges shall be sealed with a resin compatible with the original resin and recommended by the manufacturer. The sealing of the edges shall prevent premature fraying at the field cut edges.

E. Erection

1. Anchor bolts and other connectors required for securing structural FRP to in-place WORK and templates and other devices for presetting bolts and other anchors to accurate locations shall be furnished by the CONTRACTOR.

2. The CONTRACTOR shall be responsible for designing and installing any temporary bracing required for the safe erection of all structural FRP members.

F. Setting bases and bearing plates

1. Prior to the placement of nonshrink grout beneath base and bearing plates, the bottom surface of the plates shall be cleaned of bond-reducing materials. Concrete and masonry bearing surface shall also be cleaned of bond-reducing materials and be roughened to improve bonding.

2. Loose and attached base plates and bearing plates for structural members shall be set on wedges, leveling nuts, or other adjustable devices.

3. Anchor bolts shall be tightened after the supported members have been positioned and plumbed and the nonshrink grout has attained its required strength.

4. Base plates shall be grouted with nonshrink grout to assure full uniform bearing. Grouting shall be done prior to placing loads on the structure.

G. Field Assembly

1. Structural frames shall be set accurately to the lines and elevations indicated. The various members shall be aligned and adjusted to form a part of a complete frame or structure before permanent fastening. Bearing surfaces and other surfaces that will be in permanent contact shall be cleaned before assembly. Necessary adjustments to compensate for discrepancies in elevations and alignments shall be performed.

2. Individual members of the structure shall be leveled and plumbed within required tolerances. The CONTRACTOR shall provide and install all temporary bracing required until structure is complete.

H. Misfits at Bolted Connections

1. Where misfits in bolting are encountered, the ENGINEER shall be immediately notified. The CONTRACTOR shall submit a method to remedy the misfit for review by the ENGINEER. The ENGINEER will determine whether the remedy is acceptable or if the member must be refabricated. Methods of remedy may include, but are not limited to the following:

   a. Reaming holes that must be enlarged to admit oversized bolts.

   b. Drilling additional holes in the connection, to conform to manufacturer's standards for bolt spacing, end, and edge distances, and adding additional bolts.

   c. Rejecting the improperly fabricated member and fabricating a new member to ensure proper fit.

2. Mis-sized or misaligned holes in members shall not be enlarged by burning or by the use of drift pins.

3. The CONTRACTOR shall pay costs associated with the repair of misfits.

END OF SECTION

SECTION 07 10 00 – DAMPPROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dampproofing

B. Related Requirements

1. 07 21 13 – Foundation Insulation

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

American Society for Testing and Materials (ASTM)	
ASTM D 1187	Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM D 1227	Emulsified Asphalt Used as a Protective Coating for Roofing

1.3 SUBMITTALS

A. The Contractor shall furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

1.4 ACTION SUBMITTALS

A. Product Data

1. Manufacturer's specifications, technical data, installation methods, and maintenance instructions.

B. Certificates

1. Certification by the dampproofing Manufacturer that the dampproofing provided is suitable for, and compatible with, the required installation.

2. Certification by the dampproofing Manufacturer that the products supplied comply with local regulations controlling the use of volatile organic compounds (VOCs).

3. Certification of Manufacturer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, Manufacturer's products, and contact information of the consultant firm of record, general contractor and Owner.

4. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, and contact information of the consultant firm of record, general contractor and Owner.

C. Application Schedule

1. Furnish a detailed and complete application schedule indicating location and detail of installation.

D. Samples

1. When requested by Engineer, submit samples of the materials proposed. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by Engineer. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve Contractor from compliance with the Contract Documents.

1.5 QUALITY ASSURANCE

A. Qualifications

1. Manufacturers

a. Minimum of 10 years of dampproofing manufacturing experience.

b. Minimum of 5 similar successful projects over the most recent 10 years, employing similar products, materials, applications, and performance requirements.

2. Installers

a. Minimum of 5 years' experience in the successful completion of at least 5 projects of similar size and scope, employing similar products, materials, applications, and performance requirements.

B. Manufacturer's Technical Field Representative

1. The Contractor shall arrange for a Manufacturer's technical field representative to be on Site for at least 3 days, beginning at the start of surface preparation and continuing through application, to train the installers and to supervise the WORK. The Manufacturer's technical field representative shall observe as necessary to certify in writing that the completed Work has been performed according to the Manufacturer's instructions.

1.6 WARRANTY

A. Manufacturer Warranty

1. Furnish Manufacturer's 5-year written warranty to cover defects in materials, products, and manufacturing workmanship.

B. Special Warranty

1. The Contractor shall furnish separate, but concurrently running, 5-year written warranty to cover labor.

C. Warranty Provisions

1. Warranties shall be non-prorated for the entire warranty period.

2. The term of the warranties shall begin on the date of Substantial Completion.

PART 2 PRODUCTS

2.1 DAMPROOFING

A. Dampproofing shall be suitable for, and compatible with, the insulation provided under Section 07 21 13 – Foundation Insulation.

B. Manufacturer and Product, or Equal:

1. MasterSeal 615 by BASF, including primer as recommended by Manufacturer.

C. Performance Requirements

1. Cold-applied water-based emulsified-asphalt dampproofing and vapor-retarding coating for concrete and concrete block foundation and cavity wall applications, suitable for installation on “green” or slightly damp surfaces.

2. Shall be reinforced with short fibers for application by brush or spray.

3. Dampproofing shall comply with ASTM D 1227, Type 2, Class I, and ASTM D 1187, Type 1.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer’s original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer’s written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer’s written instructions.

3.2 APPLICATION SCHEDULE

A. Dampproofing shall be installed on exterior face of foundation walls from top of footing, up to 2-inches (50.8 mm) below finish grade line, to continuously dampproof below grade rooms or other internal spaces.

B. Dampproofing shall also be installed elsewhere, where noted on the Contract Drawings.

C. Protection board shall be applied at locations where foundation insulation is not otherwise provided in order to protect the dampproofing during backfill operations.

3.3 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after installation.

B. Protect surrounding Work from damage that may result from operations under this Section.

3.4 INSPECTION

A. The Contractor shall be totally responsible for the proper performance and completion of the Work under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

C. The Contractor shall verify dimensions, tolerances, and method of attachment with adjacent Work.

1. Examine substrates, areas, and conditions where dampproofing will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed dampproofing.

a. Surfaces to receive dampproofing shall be dry, free of oil, dirt, dust and other contaminants and loose materials, and shall be in the proper condition as indicated by the Manufacturer prior to the application of the dampproofing materials.

b. Concrete, and cementitious products shall have been completely cured and the surface shall be dry and free from frost at the time of application.

2. Notify Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by Contractor shall indicate Contractor's acceptance of the substrate, areas, and conditions.

3.5 SURFACE PREPARATION

A. Surface preparation shall be in compliance with the applicable references and with the Manufacturer's written instructions.

B. Coatings, including curing compounds, form release agents, and other substances shall be removed as recommended by the dampproofing Manufacturer.

C. Protrusions, bumps, ridges, and loose substrate surface materials shall be removed by sanding or grinding.

D. Trowelable leveling and patching compounds shall be used per dampproofing Manufacturer's written instructions to fill cracks, holes, and depressions.

E. Immediately before application of dampproofing materials, scrape surfaces to be covered free from foreign materials and brush clean.

F. Substrate shall be swept to remove all loose materials prior to beginning dampproofing installation.

3.6 PREPARATION

A. Sequence installation properly with the installation and protection of other Work, so that neither will be damaged by the installation of the other.

1. Do not begin dampproofing until penetrations have been installed so that dampproofing will not be penetrated or damaged by subsequent Work.

2. Do not begin dampproofing before plumbing, electrical, mechanical, and structural items under or passing through dampproofing have been secured in proper positions and appropriately sealed and protected.

3.7 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with applicable references, and with Manufacturer’s written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the Engineer.

B. Particular care shall be given to the application of dampproofing at construction joints.

C. Primer, if recommended by the Manufacturer for the application, shall be applied per the Manufacturer's recommended procedures.

D. Surfaces to be dampproofed shall receive 2 heavy coats, the first coat being carefully applied so that "holidays" or untreated air-bubble depressions in the surface shall be completely filled and the second coat shall provide a 100 percent coating of the surface.

E. Install foundation insulation in Section 07 21 13 – Foundation Insulation, against dampproofing.

F. Dampproofing shall be cured prior to backfilling.

G. Install protection board against dampproofing as recommended in writing by the dampproofing manufacturer.

3.8 CLEANING, FINISHING, AND PROTECTION

A. Dampproofing shall be protected from damage from subsequent construction operations.

B. The Contractor shall make adjustments required until accepted.

C. Damaged or defective items shall be removed and replaced as determined by the Engineer.

D. When dampproofing Work is completed, remove unused materials, containers, and equipment, and clean the Site of dampproofing debris.

END OF SECTION

SECTION 07 14 00 – FLUID APPLIED WATERPOOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fluid-applied waterproofing

1.2 RELATED REQUIREMENTS

A. 01 33 00 - Contractor Submittals
B. 01 77 00 - Project Closeout

1.3 SUBMITTALS

A. Submit Shop Drawings, product data and samples in accordance with Section 01 33 00 - Contractor Submittals.

1.4 ACTION SUBMITTALS

A. Product Data

1. Submit manufacturer's product data including installation instructions. Submit manufacturer's statement of product compatibility with substrate and adjacent materials.

B. Samples

1. Submit samples of cured membrane, scrim, prefabricated drainage mat, and geotextiles.

C. Closeout Submittal

1. Submit warranty in accordance with Section 01 77 00 - Project Closeout.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications

1. Company must specialize in waterproofing.
2. Must be waterproof membrane manufacturer trained and approved.
3. Experience: Continuously applied fluid applied waterproofing for 3 years.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in sealed, undamaged original containers, with manufacturer's labels and seals intact.

1.7 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

American Society for Testing and Materials (ASTM)	
ASTM C836	Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
ASTM C661	Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
ASTM D816	Standard Test Methods for Rubber Cements.
ASTM D1644	Standard Test Methods for Nonvolatile Content of Varnishes.
ASTM D2370	Standard Test Method for Tensile Properties of Organic Coatings.
ASTM D2697	Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings.
ASTM E96	Standard Test Methods for Water Vapor Transmission of Materials

1.8 QUALITY ASSURANCE

A. Qualifications

1. Installers

a. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of fluid applied waterproofing membranes.

2. Manufactuer

a. Obtain waterproofing materials from a single manufacturer regularly engaged in manufacturing the product.

B. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.9 CONDITIONS

A. Ambient Conditions:

1. Do not apply waterproofing when substrate and ambient temperatures are below 50 degrees F or above 100 degrees F.

2. Perform WORK only when existing and forecast weather conditions are within manufacturer's recommendations.

3. Do not apply membrane if rainfall is forecast or imminent within 12 hours.

B. Protection

1. Protect adjacent areas not indicated to be waterproofed. Where necessary, apply pressure sensitive masking tape to prevent staining of surfaces to remain exposed wherever

materials abutt other finish surfaces. Provide additional covering necessary to supplement tape.

C. Clearance

1. Maintain minimum 24 inches clearance for product application. For areas with less clearance, apply trowel grade membrane by hand.

1.10 ADMINISTRATIVE REQUIREMENTS

A. Sequencing

1. Do not begin Work until substrate has been completed and penetrations have been installed so membrane will not be penetrated or damaged by subsequent work.

2. Install waterproof membrane before placement of concrete slab.

B. Scheduling

1. Do not begin application of membrane before plumbing, electrical, mechanical, and structural items under or passing through membrane have been positively secured in proper positions and appropriately protected.

1.11 WARRANTY

A. Warranty

1. Provide 5 year written warranty covering materials and installation for watertight condition.

2. Warranty shall be by material manufacturer, fabricator, installer, and Contractor, jointly and severally, and be signed by officers of each company.

PART 2 PRODUCTS

2.1 MEMBRANE SYSTEM

A. Fluid Applied Waterproofing System: **W.R. Meadows Inc., Hydralastic 836** or approved equal.

B. Physical Properties

Property	Typical Value	Test Method
Solids Content By Weight	98%	ASTM D-1644
Solids Content By Volume	98%	ASTM D-2697
Tensile Strength	70 psi	ASTM D-2370
Elongation	440%	ASTM D-2370
Water Vapor Transmission	0.07 perm inches	ASTM E-96
Shore 00 Hardness	55	ASTM C-661
Low Temperature Flex	-20° F (-28.9° C) pass ¼" (6.4 mm) mandrel	ASTM D-816

Property	Typical Value	Test Method
Service Temperature	-40° F – 158° (-40° – 70° C) continuous service	
Minimum Application Temperature	Above 30° F (-1° C) and rising	
VOC Content	26 g/L	

C. Prefabricated Drainage Mat: Preformed plastic sheet, one side smooth with concave dimples, other side bonded to geotextile fabric. Use **W.R. Medows MEL-DRAIN** or approved equal.

2.2 ACCESSORIES

A. Joint Tape: 6” (150 mm) wide reinforcing fabric for corners, crack, and joint treatment.

1. REINFORCING FABRIC HCR by W. R. MEADOWS.

B. Reinforced Joint Tape for outside corners subject to backfill.

1. PRECON TAPE by W.R. MEADOWS.

C. Detailing Membrane: BEM by W. R. MEADOWS

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrate before beginning installation to verify that:

1. Concrete has been cured for minimum of 14 days.

2. Surfaces are light broom finish or smoother; dry, clean, firm, and free from laitance, frost, dust, dirt, oil, curing compounds or other foreign matter detrimental to performance of membrane.

3. Voids, cracks, holes, and other damaged surfaces have been repaired with materials compatible with membrane.

4. Joints and transitions between planes are sharply formed and free of broken edges or loose aggregate, and are completely free of preformed joint fillers, sealants, or back-up materials to depth at least twice width of joint.

3.2 PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

C. Do not apply waterproofing to surfaces unacceptable to manufacturer.

D. Clean concrete surfaces so they are free of all coatings, dirt, oil, paints and any other contaminants.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Remove and patch all concrete form ties.

G. Treatment of Existing Cracks and All Non-Structural Joints

1. Identify and install detailing membrane in all cracks and all non-structural joints per manufacturer’s written instructions.

H. Treatment of Inside & Outside Corners

1. Install detailing membrane per manufacturer’s written instructions to create a minimum ¾” fillet in all inside corners.

3.3 MEMBRANE APPLICATION

A. General: Apply in accordance with manufacturer's recommendations and standard details.

1. Maintain membrane free of dirt, debris and traffic until protective cover is in place. Do not penetrate membrane.

2. Horizontal Applications: Cover with 2-inches sand layer, free from debris.

3. Provide minimum cured membrane thickness of 60 mils dry.

3.4 CLEANING

A. Clean stains from adjacent surfaces as recommended by manufacturer. Remove foreign matter from finished membrane surfaces.

3.5 PROTECTION

A. Traffic: Do not allow traffic on uncured membrane surfaces.

B. Prefabricated Drainage Mat: Cover membrane with drainage mat as soon as possible.

C. Backfill immediately using care to avoid damaging waterproofing membrane system.

END OF SECTION

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SECTION 07 19 00 – SURFACE APPLIED WATER REPELLENTS

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall provide Surface Applied Water Repellants and appurtenant Work, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

American Society of Testing and Materials (ASTM)	
ASTM C 140	Water Repellency in Water Absorption
ASTM D 3278	Standard Test Method for Flashpoint of Liquids by Small Sealed Closed-End Apparatus
ASTM E 514	Standard Test Method for Water Penetration and Leakage through Masonry
Environmental Protection Agency (EPA): Method 24	

1.3 CONTRACTOR SUBMITTALS

A. The Contractor shall furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Literature: Manufacturer's specifications, technical data, installation methods, and maintenance instructions.

C. Warranty: Submit a copy of the warranty.

D. Certifications:

1. Certification by the Surface Applied Water Repellant Manufacturer that the water repellant provided is suitable for, and compatible with, the required installation.

2. Certification by the Surface Applied Water Repellant Manufacturer that the water repellant is suitable for, and compatible with, the masonry, mortar, and admixtures provided under Section 04 22 00 – Reinforced Concrete Block Masonry.

3. Certification of Manufacturer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, Manufacturer's products, and contact information of the consultant firm of record, general contractor and Owner.

4. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, and contact information of the consultant firm of record, general contractor and Owner.

5. Certification by the Manufacturer's field representative that surfaces have been prepared and the products have been applied in accordance with the Manufacturer's recommendations.

6. Certification by the Manufacturer that the products provided achieves a Class E rating, when tested in accordance with ASTM E 514.

7. Certification by the Manufacturer that the products supplied complies with local regulations controlling the use of volatile organic compounds (VOCs).

8. Certification by the Manufacturer's field representative that the products provided achieves a passing result when tested in accordance with RILEM Test Method II.4.

9. When requested by the Engineer, furnish other certifications as may be required to demonstrate compliance with the Contract Documents.

E. Application Schedule: Furnish a detailed and complete application schedule indicating location and detail of installation.

F. Samples: When requested by Engineer, submit samples of the materials proposed. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by Engineer. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish and quality of each item. Approval of samples shall not relieve Contractor from compliance with the Contract Documents.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Surface Applied Water Repellants shall be provided by a single Manufacturer.

B. Manufacturer Qualifications:

1. Surface Applied Water Repellant Manufacturer shall have a minimum of 20 years of water repellant manufacturing experience.

2. Surface Applied Water Repellants Manufacturer shall have a minimum of 5 similar successful projects over the most recent 10 years, employing similar products, materials, applications, and performance requirements.

3. Manufacturers without these qualifications will not be accepted.

C. Installer Qualifications:

1. Installer shall have a minimum of 5 years' experience in the successful completion of at least 5 projects of similar size and scope, employing similar products, materials, applications, and performance requirements.

2. Installer shall be trained, certified, and authorized by the Manufacturer to install the Manufacturer's product, when applicable.

3. Installers without these qualifications will not be accepted.

D. Manufacturer's Technical Field Representative: The Contractor shall arrange for a Manufacturer's technical field representative to be on Site, at the beginning of water repellent application (and periodically throughout), to train the installers and to supervise the Work. The Manufacturer's technical field representative shall observe as necessary to certify in writing that the completed Work has been performed according to the Manufacturer's instructions.

E. Field Sample:

1. Coordinate field sample with other field samples required in other Sections.

2. Prior to installation, erect sample wall panel mock-up on Site using materials and joint details required for final Work. Provide special features as directed.

3. The field sample shall not exhibit any deterioration of color or finish of the substrate, including but not limited to discoloration, staining, streaking, and fading.

4. Apply material in accordance with the requirements in Part 3 – Execution, below.

5. Manufacturer's technical field representative shall be present to review technical aspects and conduct the field sample installation.

   a. Apply Surface Applied Water Repellant to 2-feet (.61 m) by 2-feet (.61 m) test panel area, in accordance with Manufacturer's written instructions, to determine coverage rates, effectiveness, aesthetics, and desired results.

   b. Allow 10 days or until test panels are thoroughly cured before evaluating final appearance and results.

   c. Conduct RILEM test method II.4 to evaluate water repellent performance.

   d. Do not begin full-scale application until test panels are inspected and approved by the Engineer.

   e. Do not begin full-scale application until test panels are inspected and approved.

6. Obtain the Engineer's acceptance of qualities of field sample before installation. Modify and/or reconstruct field sample at the direction of Engineer until acceptance. Retain field sample during construction as a standard for judging completed Work. Do not alter, move, or destroy field sample until directed by the Engineer.

7. Acceptance of field sample shall not relieve the Contractor from compliance with the Contract Documents.

1.5 SPECIAL WARRANTY PROVISIONS

A. The Contractor shall furnish Manufacturer's extended 10-year warranty to cover defects in materials, products, and manufacturing workmanship.

B. The Contractor shall furnish separate, but concurrently running, 5-year written warranty to cover defects in installation and associated later.

C. All warranty items shall be non-prorated for the entire warranty period.

D. The term of the warranty shall begin on the date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL

A. Surface Applied Water Repellant shall be a water-based, clear silane/siloxane sealer designed to provide protection for split-faced, lightweight and standard concrete masonry units.

2.2 SURFACE APPLIED WATER REPELLANT

A. Manufacturer and Product, or Equal:

1. Subject to the requirements herein, provide Manufacturer and product listed below, or equal.

a. Hydrozo, a Division of BASF; Enviroseal PBT.

2. Description:

a. Surface Applied Water Repellant shall comply with standard specification, ASTM D 3278 (>212 deg F [> 100 deg C]), ASTM C 140 (45 percent reduction in weight gain), ASTM E 514 (99 percent reduction in weight gain), and VOC content shall be less than 2.50 lb/gal (1.13 kg/liter) per EPA method 24.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer’s original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer’s written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 APPLICATION SCHEDULE

A. Surface Applied Water Repellant shall be applied to above grade, exposed concrete masonry blocks, and all precast sills and caps.

B. Surface Applied Water Repellant shall also be applied elsewhere, where indicated on the Contract Drawings.

3.3 PROJECT CONDITIONS

A. Comply with Manufacturer’s written instructions for environmental conditions before, during, and after installation.

B. Protect surrounding Work from damage that may result from operations under this Section.

C. Protect against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial.

3.4 INSPECTION

A. The Contractor shall be totally responsible for the proper performance and completion of the Work under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

C. The Contractor shall verify coordination with adjacent Work.

1. Examine substrates, areas, and conditions where the product will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed the product.

a. Surfaces to receive the product shall be dry, free of oil, dirt, dust and other contaminants and loose materials, and shall be in the proper condition as indicated by the Manufacturer prior to the application of the Surface Applied Water Repellants materials.

b. Masonry, concrete, and cementitious products shall have been completely cured and the surface shall be dry and free from frost at the time of application.

2. Notify the Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the Contractor shall indicate Contractor's acceptance of the substrate, areas, and conditions.

3.5 SURFACE PREPARATION

A. Surface preparation shall be in compliance with the applicable references and with the Manufacturer's written instructions.

B. Coatings, including curing compounds, form release agents, and other substances shall be removed as recommended by the Surface Applied Water Repellant Manufacturer.

C. Substrate shall be swept to remove all loose materials prior to beginning application.

3.6 PREPARATION

A. Sequence installation properly with the installation and protection of other Work, so that neither will be damaged by the installation of the other.

3.7 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with applicable references, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the Engineer.

B. Surfaces shall receive complete coats and coverage rates as recommended in writing by the Manufacturer.

3.8 CLEANING, FINISHING, AND PROTECTION

A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of the Contractor.

2. Residue shall not be left on any surfaces.

3. The surfaces of materials adjoining the product shall be cleaned free of overspray and smears of the product or other soiling due to the installation of the product.

B. Upon completion of the application, the product and appurtenances shall be cleaned of dirt and other foreign matter to the satisfaction of the Engineer.

1. Cleaning shall be performed again immediately prior to acceptance of the WORK, as determined by the Engineer.

2. Cleaning shall be performed in accordance with the Manufacturer's written instructions.

C. The Contractor shall make adjustments required and retest until accepted.

D. The product shall be protected from damage from subsequent construction operations.

E. Damaged or defective items shall be removed and replaced at the direction of the Engineer.

F. When the product Work is completed, remove unused materials, containers, and equipment, and clean the Site of Surface Applied Water Repellant debris.

END OF SECTION

SECTION 07 21 00 THERMAL INSULATION

PART 1 GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):

a. C518, Standard Test Method for Steady-State Thermal TransmissionPrope1ties by Means of the Heat Flow Meter Apparatus.

b. C578, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

c. C665, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

d. Dl 622, Standard Test Method for Apparent Density of Rigid Cellular Plastics.

e. D4397, Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.

f. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

g. E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.

1.2 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:

a. Manufacturer's product literature identifying products proposed for use.
b. Drawings letter indicating proposed locations of holes for
c. injection of foam-in-place insulation in exposed walls.

1.3 DELIVERY, STORAGE, AND HANDLING

A. On packaging clearly identify manufacturer, contents, brand name, applicable standard, and R-value.

B. Store materials off ground and keep them dry. Protect against weather, condensation, and damage.

PART 2 PRODUCTS

2.1 BATT INSULATION AND FASTENERS

A. Fiberglass or Mineral Wool Batts:

1. ASTM C665, Type I, with no vapor retarder with R-values as indicated on Drawings.

2. Manufacturers:

a. CertainTeed Corp.
b. Owens-Corning Insulating Systems.
c. Johns Manville.

B. Fasteners: As recommended by insulation manufacturer.

C. Tape: As recommended by insulation manufacturer.

2.2 SILLSEALER

A. Polyethylene Foam:

1. Size: 3-1/2 inches wide.

2. Manufacturers and Products:

a. Dow Chemical Company; Styrofoam Sill Seal.
b. TVM Building Products; TVM Sill Seal.

2.3 SHEET VAPOR RETARDER

A. Polyamide Film: 2-mil thick.

1. Water Vapor Pe1meance:

a. ASTM E96/E96M; D1y Cup Method: 1.0 perms.
b. ASTM E96/E96M; Wet Cup Method: 10.0 perms.

2. Fire Hazard Classification: ASTM E84.

a. Maximum Flame Spread Index: 20.
b. Maximum Smoke Developed Index: 55.
c. Manufacturer and Product: CertainTeed Corp.; MemBrain.

B. Sealant and Tape: As recommended by sheet vapor retarder manufacturer.

2.4 MASONRY FILL INSULATION

A. Foam-in-Place Insulation:

1. R-Value at 1-inch Thickness: 4.6, minimum, with a total R-value of 11.4 ci

2. Foam Density: 0.72 pounds per cubic foot.

3. Surface Burning Characteristics, ASTM E84:

a. Flame Spread: 25, maximum.
b. Smoke Developed: 200, maximum.

4. Water Vapor Transmission: 17 perms, maximum.

5. Manufacturers and Products:

a. cfiFoam, Inc.; Core Foam Masonry Foam Insulation.

b. C.P. Chemical Co., Inc.; Tripolymer PRMIU or 105.

2.5 RIGID INSULATION

A. Extruded Polystyrene Foam:

1. ASTM C578, Type IV.

2. Flame Spread: Less than 25 when tested in accordance with ASTM E84.

3. Thickness: As shown on Drawings.

4. Manufacturers and Products:

a. Dow Chemical Co.; Styrofoam Square Edge.
b. UC Industries; Foamular.

B. Adhesives and Fasteners: As recommended by insulation manufacturer.

2.6 SPRAY FOAM INSULATION

A. General purpose, closed cell, semi-rigid, single-component polyurethane foam:

1. Thermal resistance (ASTM C518): R-3.8 per inch thickness.

2. Core Density (ASTM Dl622): 1.5 pcf.

3. Fire Resistance (ASTM E84):

a. Flame Spread: 15 or less.
b. Smoke Developed: 20 or less.

4. Manufacturer and Product: Dow Chemical Co.; GREAT STUFF PRO.

PART 3 EXECUTION

3.1 BATT INSULATION

A. Install in accordance with manufacturer's instructions and as specified below:

1. Install in widths required by framing spacing.

2. Fit tightly to ensure continuous seal.

3. Where electrical outlets, ducts, pipes, vents, or other utility items occur, place insulation on cold weather side of obstruction.

4. Protect installed insulation from tears and other damage until covered with finish material.

5. Remove and replace damaged material.

3.2 SILL SEALER

A. Install under metal tracks resting on concrete floor slabs.

3.3 SHEET VAPOR RETARDER

A. Install in accordance with the following:

1. Apply to wall framing in sheets as large as possible.
2. Lap joints 6 inches.
3. Seal joints with sealant and tape as recommended by sheet vapor retarder manufacturer.
4. Fit tightly and seal around penetrations.
5. Repair minor tears or holes with tape.
6. Replace sheets with tears or holes, which require more than 6-inch length of tape to repair.

3.4 MASONRY FILL INSULATION

A. Foam-in-Place Insulation:

1. Inject foam into ungrouted cells of concrete masonry units through holes drilled in mortar joints at interior face of wall in accordance with manufacturer's instructions. Locate holes in inconspicuous us locations as approved by Engineer.

2. Upon completion, clean excess foam from face of masonry in accordance with manufacturer’s instructions.

3. Fill and patch holes with mortar in accordance with Section 04 22 00, Reinforced Concrete Block Masonry.

3.5 RIGID INSULATION

A. Install in accordance with the following:

1. Install boards in location and in thickness as shown on Drawings.
2. Cut insulation with saw, knife, or other sharp tool to fit tightly around obstructions.
3. Butt insulation boards together tightly at joints.
4. Apply to masonry or concrete with fasteners recommended by insulation manufacturer and approved by Fluid-Applied Waterproofing Membrane manufacturer where rigid insulation is used as protection board.

3.6 SPRAY FOAM INSULATION

A. Surface Preparation: Free of dirt, grease, oil, loose paint, excessive rust scale, or other foreign material, which would prevent adequate adhesion.

B. Ambient Temperature: Between 25 degrees F and 120 degrees F throughout application process.

C. Application:

1. Apply in accordance with manufacturer's instructions.
2. Apply spray foam insulation in locations shown on Drawings.

D. Cleaning: Clean overspray from adjacent surfaces in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 07 21 13 – FOUNDATION INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Foundation insulation

B. Related Requirements

1. Section 01 33 00 – Contractor Submittals
2. Section 07 10 00 – Dampproofing

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

American Society for Testing and Materials (ASTM)3zx	
ASTM C 272	Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
ASTM C 518	Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 578	Rigid, Cellular Polystyrene Thermal Insulation
ASTM D 1621	Standard Test Methods for Compressive Properties of Rigid Cellular Plastics
ASTM D 4716	Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head

1.3 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

1.4 ACTION SUBMITTALS

A. Product Data

1. Manufacturer's specifications, technical data, installation methods, and maintenance instructions.

B. Certifications:

1. Certification by the Manufacturer that the foundation insulation is suitable for, and compatible with, the dampproofing provided under Section 07 10 00 – Dampproofing.

C. Application Schedule

1. Furnish a detailed and complete application schedule indicating location and detail of installation.

D. Samples

1. When requested by the Engineer, submit samples of the materials proposed. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish, and color. New samples shall be resubmitted of each, as required, until approved by the Engineer. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the Contractor from compliance with the Contract Documents.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility

1. Foundation insulation shall be provided by a single Manufacturer.

B. Qualifications

1. Manufacturer

a. Minimum of 10 years of foundation insulation manufacturing experience.

b. Minimum of 5 similar successful projects over the most recent 10 years, employing similar products, materials, applications, and performance requirements.

1.6 WARRANTY

A. Manufacturer Warranty

1. Furnish the Manufacturer's 15-year written thermal warranty.
2. Warranties shall be non-prorated for the entire warranty period.

PART 2 PRODUCTS

2.1 FOUNDATION INSULATION

A. Foundation insulation shall be suitable for, and compatible with, the dampproofing provided under Section 07 10 00 – Dampproofing.

2.2 MANUFACTURER

A. Manufacturer and Product, or Equal

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal:

a. DuPont Styrofoam Perimate XPS Foam Insulation.

B. Description

1. Foundation insulation shall be a 2-1/8-inch (51 mm) extruded closed cell polystyrene foam board with drainage grooves and with integral high-density skins of same material.

2. Foundation insulation shall comply with ASTM C 578 Type IV, and shall have a minimum R-value of 10.0 (5 per inch) at 75 degrees F (23.9 degrees C), sq ft × h × degrees F/Btu, in accordance with ASTM C 518. Foundation insulation shall have a minimum compressive strength of 30 psi in accordance with ASTM D 1921, maximum water absorption of 0.1 percent by volume, in accordance with ASTM C 272, and drainage capacity at 1200 psf, gradient 0.19 of 3 gal/min/ft in accordance with ASTM D 4716.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 APPLICATION SCHEDULE

A. Install foundation insulation vertically to reach a depth of 3-feet zero-inches (.91 m) below grade, or to depth shown on the Drawings (whichever is greater) to continuously insulate the exterior face of exterior foundation walls, and other surfaces and substrates where indicated, in strict accordance with Manufacturer's written instructions.

B. Foundation insulation shall also be installed elsewhere, where noted on the Drawings.

3.3 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after installation.

B. Protect surrounding Work from damage that may result from operations under this Section.

3.4 INSPECTION

A. The Contractor shall be totally responsible for the proper performance and completion of the Work under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

C. The Contractor shall verify dimensions, tolerances, and method of attachment with adjacent Work.

1. Examine substrates, areas, and conditions where foundation insulation will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed foundation insulation.

a. Surfaces to receive foundation insulation shall be dry, free of oil, dirt, dust and other contaminants and loose materials, and shall be in the proper condition as indicated by the Manufacturer prior to the application of the foundation insulation materials.

b. Masonry, concrete, and cementitious products shall have been completely cured and the surface shall be dry and free from frost at the time of application.

2. Notify the Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the Contractor shall indicate Contractor's acceptance of the substrate, areas, and conditions.

3.5 PREPARATION

A. Sequence installation properly with the installation and protection of other Work, so that neither will be damaged by the installation of the other.

3.6 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with applicable references, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the Engineer.

B. Foundation insulation shall be set with top 2-inches (51 mm) below finish grade and held firmly in place in the freshly dampproofed concrete with additional daubs of dampproofing mastic in strict accordance with the Manufacturer's instructions. Refer to Section 07 10 00 – Dampproofing.

3.7 CLEANING, FINISHING, AND PROTECTION

A. Foundation insulation shall be protected from damage from subsequent construction operations.

B. The Contractor shall make adjustments required until accepted.

C. Damaged or defective items shall be removed and replaced at the direction of the Engineer.

D. When foundation insulation Work is completed, remove unused materials, containers, and equipment, and clean the Site of foundation insulation debris.

END OF SECTION

SECTION 07 22 16 – ROOF INSULATION

PART 1 GENERAL

1.1 THE SUMMARY

A. CONTRACTOR shall provide roof insulation and appurtenant WORK for Metal Roof Panels, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. American Society for Testing and Materials (ASTM):

ASTM C 209	Standard Test Methods for Cellulosic Fiber Insulating Board
ASTM C 1289	Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D 1621	Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
ASTM D 1622	Standard Test Method for Apparent Density of Rigid Cellular Plastics
ASTM D 2126	Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
ASTM D 2842	Standard Test Method for Water Absorption of Rigid Cellular Plastics
ASTM E 84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E 96	Standard Test Methods for Water Vapor Transmission of Materials

C. Building Code: Refer to the Drawings to determine which Building Code applies. The applicable Building Code, defined by the Drawings, is referenced herein as “the CODE.”

D. Factory Mutual (FM): FM Standard 4450/4470; Class 1.

E. Underwriters Laboratories (UL): UL Standard 790; Class A.

F. UL of Canada:

CAN/ULC-S770	Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 –Submittal Procedures.

B. Literature: Manufacturer’s specifications, technical data, installation methods, and maintenance instructions.

C. Warranty: Submit a copy of the warranty.

D. Certification:

1. Certification by the roof insulation Manufacturer that the roof insulation provided is suitable for, and compatible with, the required installation.

2. Certification of Manufacturer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, Manufacturer's products, and contact information of the consultant firm of record, general contractor and owner.

3. Certification by the roof insulation Manufacturer that the roof insulation may be installed directly on structural metal decking and does not require a thermal barrier or automatic fire suppression per the CODE.

4. When requested by ENGINEER, furnish other certifications as may be required to demonstrate compliance with the Contract Documents.

E. Application Schedule: Furnish a detailed and complete application schedule indicating location and detail of installation.

F. Samples: When requested by ENGINEER, submit samples of the materials proposed. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish, and color. New samples shall be resubmitted of each, as required, until approved by ENGINEER. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve CONTRACTOR from compliance with the Contract Documents.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Roof Insulation shall be provided by a single Manufacturer.

B. Manufacturer Qualifications:

1. Roof insulation Manufacturer shall have a minimum of 20 years of roof insulation manufacturing experience.

2. Roof insulation Manufacturer shall have a minimum of 5 similar successful projects over the most recent 10 years, employing similar products, materials, applications, and performance requirements.

3. Manufacturers without these qualifications will not be accepted.

1.5 SPECIAL WARRANTY PROVISIONS

A. Furnish Manufacturer's 20-year written thermal warranty.

B. Warranties shall be non-prorated for the entire warranty period.

C. The term of the warranties shall begin on the date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL

A. Roof insulation herein is for roof insulation at metal roof panel installation provided under Section 07 42 16 – Metal Wall, Roof and Soffit Panels.

B. Roof insulation shall be recommended by the Manufacturer for the installation indicated.

C. Roof insulation shall be polyisocyanurate with integrally laminated fiber-reinforced felt facers.

D. Roof insulation shall be approved for use without the requirement of a thermal barrier or automatic fire suppression system, as required by the CODE.

E. Roof insulation shall be approved by the metal roof panel Manufacturer for the roof panels provided under Section 07 42 16 – Metal Wall, Roof and Soffit Panels.

2.2 ROOF INSULATION

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal.

a. Atlas Roofing Corporation, AC Foam II.

B. Description:

1. Installed minimum R-value shall be: 30 hr/Btu/sq ft/degrees F.

2. Roof insulation shall meet FM Standard 4450/4470, Class 1 and UL Standard 790, Class A ratings, and shall comply with ASTM C 1289, Type II, Class 1.

3. Roof insulation shall meet UL Standard 1256; Construction No.120 and No.123.

4. Performance Requirements:

Compressive Strength	ASTM D 1621	25 psi
Water Absorption	ASTM C 209/D 2842	< 1 percent < 3.5 percent
Moisture Vapor Transmission	ASTM E 96	< 1.5 perm
Dimensional Stability (percent Linear Change L&W)	ASTM D 2126 7-day 158 degrees F/ 95-100 percent RH	less than 2 percent
Flame Spread	ASTM E 84	25 - 50
Smoke Developed	ASTM E 84	50 - 170
Density	ASTM D 1622	2 lb/cu ft (nominal)
Service Temperature	-	-100 deg F to 250 deg F
LTTR Value (test value: 4-inch thickness)	CAN/ULC-S770	25 hr/Btu/sq ft/deg F

2.3 VAPOR BARRIER

A. Refer to Section 07 42 16 – Metal Wall, Roof and Soffit Panels.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 APPLICATION SCHEDULE

A. Roof insulation shall be installed on roof deck to continuously insulate the building roofs, in strict accordance with Manufacturer's written instructions.

B. Roof insulation shall also be installed elsewhere, where noted on the Drawings.

3.3 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after installation.

B. Protect surrounding WORK from damage that may result from operations under this Section.

3.4 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where roof insulation will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed roof insulation.

a. Surfaces to receive roof insulation shall be dry, free of oil, dirt, dust and other contaminants and loose materials, and shall be in the proper condition as indicated by the Manufacturer prior to the application of the roof insulation materials.

b. Masonry, concrete, and cementitious products shall have been completely cured and the surface shall be dry and free from frost at the time of application.

2. Notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by CONTRACTOR shall indicate CONTRACTOR's acceptance of the substrate, areas, and conditions.

3.5 PREPARATION

A. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

3.6 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with applicable references, with the requirements of the Code, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by ENGINEER.

B. Roof Insulation at Buildings:

1. Install vapor barrier – Refer to Section 07 42 16 – Metal Wall, Roof and Soffit Panels.

2. Install no more roof insulation on the roof than can be protected in case of sudden adverse weather. Any roof insulation becoming wet shall be removed from the Site and replaced by dry material.

3. Roof insulation shall be installed in 2 layers and shall be set loose except an approved cold spot adhesive may be used, if approved in writing by the Manufacturer.

4. Apply roof insulation with long joints continuous and at right angles to the standing seams. End joints shall be staggered.

5. The second layer shall be set over the first layer. Joints shall be evenly staggered between layers.

3.7 CLEANING, FINISHING, AND PROTECTION

A. Roof insulation shall be protected from damage from subsequent construction operations.

B. CONTRACTOR shall make adjustments required until accepted.

C. Damaged or defective items shall be removed and replaced at the direction of ENGINEER, at no additional cost to the OWNER.

D. When roof insulation WORK is completed, remove unused materials, containers, and equipment, and clean the Site of roof insulation debris.

END OF SECTION

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SECTION 07 42 16 – METAL ROOF AND SOFFIT PANELS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Metal roof and soffit panels, system support framing, and accessories.

2. The Contractor shall furnish professional design and engineering services as required for metal roof and soffit panels, accessories and appurtenances as indicated herein.

   a. Professional design and engineering services may be provided by the Manufacturer or by an independent licensed civil engineer retained by the Contractor, either of which shall comply with the requirements indicated.

3. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

B. Related Requirements

1. 01 33 00 – Contractor Submittals

2. 01 33 17 – Structural Design, Support and Anchorage

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

The Aluminum Association, Inc. (AA)	AA 6061-T6
The American Institute of Steel Construction (AISC)	
American Society for Testing and Materials (ASTM)	
ASTM A 653	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM D 226	Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 968	Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D 4128	Standard Guide for Identification and Quantitation of Organic Compounds in Water by Combined Gas Chromatography and Electron Impact Mass Spectrometry
ASTM D 4145	Standard Test Method for Coating Flexibility of Prepainted Sheet
ASTM D 4585	Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation
ASTM E 96	Standard Test Methods for Water Vapor Transmission of Materials
ASTM E 1592	Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference

ASTM E 1646	Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
ASTM E 1680	Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems
ASTM G 87	Standard Practice for Conducting Moist SO2 Tests

B. American Iron and Steel Institute (AISI)

1. Specification for the Design of Cold-Formed Steel Structural Members

C. Building Code

1. Refer to the Drawings to determine which building code applies. The applicable building code, defined by the Drawings, is referenced herein as “the CODE.”

D. FM Approval Standards, FM Global

1. FM Approval Standard 4471 for Class 1 Panel Roofs.

E. National Roofing CONTRACTOR’s Association (NRCA)

1. National Roofing and Waterproofing Manual.

F. Sheet Metal and Air Conditioning Manufacturers National Association (SMACNA).

G. Underwriters Laboratories (UL)

1. UL 580 - Tests for Uplift Resistance of Roof Assemblies

1.3 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Product Data

1. Manufacturer’s specifications, technical data, installation methods, maintenance instructions, and the following:

2. Manufacturer’s full-range color charts, indicating custom color availability, for color selection by the Owner.

C. Certifications

1. Certification of compliance with the structural requirements of paragraph 2.1.A.

2. Certification by the Manufacturer that the metal roof panels are suitable for, and compatible with, the roof insulation in 07 22 16 – Roof Insulation.

3. Certification of Manufacturer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, Manufacturer’s products, and contact information of the consultant firm of record, general contractor and owner.

4. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, and contact information of the consultant firm of record, general contractor and owner.

5. Certification from the Manufacturer that the installer is trained, certified, and authorized by the metal roof and soffit panel Manufacturer to install the Manufacturer's metal roof and soffit panel systems.

6. Certified independent laboratory test results and mill certifications demonstrating that the products and materials comply with the required tests.

7. Certification by the Manufacturer that the metal roof panels do not require a thermal barrier or automatic fire suppression system per the Code.

D. Shop Drawings and Calculations

1. Complete Shop Drawings showing location and detail of installation, and design calculations.

    a. Shop Drawings and Calculations shall be prepared, approved, and stamped by a professional civil engineer licensed per local engineering licensing laws.

    b. Shop Drawings shall be drawn to sufficient scale, showing fully-dimensioned layout, including plans, sections, elevations, and details of metal roof and soffit panels, system support framing, accessories, connections to the primary structure, joints, penetration details, preformed metal closures, flashing, gutters, down spouts, soffit panels, trim, fastenings, system caulking sealants, gaskets, appurtenances, locations of framed openings, special project specific conditions, location of custom-cut panels, provisions for expansion and contraction, and relationship to adjacent materials.

    c. Shop Drawings shall include material descriptions, finish, color, details of construction, installation, and accessories of each metal roof and soffit panel type, and accessories.

    d. Design and detail penetrations, including hot pipe penetrations, to be weathertight. Coordinate locations of penetrations.

2. Include erection drawings with written procedures to clearly explain proper installation of fasteners, trim, gaskets and sealants. Erection drawings shall also include notation requiring the installer to coordinate with other trades.

3. Include structural design calculations, in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members, for the metal roof, and soffit panel system support framing.

4. Include structural design calculations for accessories, including, but not limited to pre-engineered removable access covers and pre-engineered roof curbs.

5. Manufacturer shall review and provide comments on the Shop Drawings and calculations prior to submittal.

E. Samples

1. The Contractor shall submit 2 samples of each of the following. Unless otherwise indicated, samples shall be full size and shall show gauges, configuration, construction, finish and color proposed for the various components. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by the Engineer. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the Contractor from compliance with the Contract Documents.

2. Metal and Roof Panels

    a. Assembled half panels, with representative panel support framing, showing seam, and appurtenances; one-foot long, in color and finish indicated.

    b. 3-inch (76-mm) by 4-inch (102-mm) color samples showing substrate, finish, and color.

3. Soffit panels: 1-foot long (0.30 m) by panel width, in material, profile, finish, and color indicated.

4. The Contractor shall coordinate color samples with other Sections through the submittal process.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility

1. Metal and roof panels, and soffit panels, shall be provided by a single Manufacturer.
2. System support framing shall be provided by a single Manufacturer.
3. Accessories shall be provided by a single Manufacturer, each.

B. Qualifications

    a. Manufacturer

    b. Metal roof and soffit panel Manufacturer shall have a minimum of 20 years of metal panel manufacturing experience.

    c. Metal roof and soffit panel Manufacturer shall have a minimum of five (5) similar successful projects over the most recent 10 years, employing similar products, materials, applications, and performance requirements.

2. Installer

    a. Installer shall have a minimum of 5 years' experience in the successful completion of at least five (5) projects of similar size and scope, employing similar products, materials, applications, and performance requirements.

    b. Installer shall be trained, certified, and authorized by the Manufacturer to install the Manufacturer's product.

3. Engineer

   a. A professional civil engineer licensed in accordance with local engineering licensing laws shall design the metal roof and soffit panel system, system support framing, system components, connections, accessories and appurtenances.

C. Performance Tests

1. Roof panel performance tests shall be conducted by, or witnessed by, a recognized independent laboratory or independent professional engineer. Test results shall be certified by the independent laboratory or by the independent professional engineer who conducted or witnessed the tests.

   a. Air infiltration of the roof panel system shall be limited to 0.036 CFM/sq. ft. at a positive pressure differential of 4 psf when tested in accordance with ASTM E 1680.

   b. There shall be no uncontrolled water penetration to the building interior when the roof panel system is tested per ASTM E 1646 at a positive pressure differential of 9.2 psf.

   c. Allowable uniform uplift load capacity shall be determined in accordance with ASTM E 1592. The factor of safety against ultimate failure of the panel, batten, or clip shall be 1.65, with no increase for wind permitted. Allowable uplift capacity for conditions of gauge, span, or loading other than those tested may be determined by interpolation of the test results. Extrapolation of conditions outside the range of the test will not be permitted.

   d. Metal roof panel system shall be successfully tested in accordance with UL 580 and shall maintain a minimum Class 90 uplift rating.

   e. Metal roof panel system shall be successfully tested in accordance with FM 4471 for Class 1 approval with a 1-90 windstorm classification and a 1-SH hail storm classification.

   f. Metal roof panel system shall withstand a 250-lb concentrated load applied to a 4-square-inch (10-square-centimeters) area at the center of the panel at mid-span between supports with no panel deformation, rib buckling, or panel side lap separation which will adversely affect the weather integrity of the system.

   g. Metal and roof panels shall be thermal cycle tested a minimum of 100,000 cycles with a minimum of 1-inch (25 mm) of movement relative to the clip anchor. Panel and clips shall show that the wear will not affect structural performance or weather integrity of the system.

1.5 WARRANTY

A. Manufacturer Warranty

1. The Manufacturer shall warrant that the materials and accessories furnished in accordance with these specifications shall remain free from defects for a period of 1 year from date of shipment.

2. At the time of Substantial Completion, the Manufacturer shall warrant that the installation is not defective in and conforms to the Manufacturer's erection drawings, except for reasonable variances not impairing the usefulness thereof.

B. Special Warranties

1. The Manufacturer shall warrant against spalling, fading, chalking, peeling, cracking, checking, chipping, or erosion to base metal of the exterior panel finish, for a period of 10 years from the date of Substantial Completion. The finish shall not change color more than eight NBS units for a period of 10 years from the date of Substantial Completion.

2. Manufacturer shall provide a weathertight warranty against water penetration of the metal roof and soffit panel system, including panel joints and trim conditions for a period of 20 years from date of Substantial Completion.

C. Contractor Warranty

1. The Contractor shall furnish separate, but concurrently running, 5 year written warranty to cover installation and associated labor.

D. Warranties Term

1. The term of the warranties shall begin on the date of Substantial Completion, unless otherwise indicated.

PART 2 PRODUCTS

2.1 GENERAL

A. Structural Requirements

1. Metal roof and soffit panels, including system support framing, accessories, related assemblies, components, appurtenances, and attachment details shall comply with the Code and shall be designed and installed for resistance to the structural design criteria indicated in the Contract Documents in accordance with the Code. Where a conflict occurs between the requirements of this Section and the Code, the more stringent shall apply.

   a. Refer to Section 01 33 17 – Structural Design, Support and Anchorage for additional design criteria.

2. The Contractor shall provide additional non-standard bracing, system support framing members, reinforcements, anchors, and heavier gauge materials in order to conform to the structural design criteria indicated and to other performance requirements indicated.

3. Metal roof and soffit panels, system support framing, including accessories, shall be manufactured and installed to maintain the specified performance requirements, under the structural design criteria indicated, without defects, damage, or failure.

B. Thermal Movements: Metal roof and soffit panel system, including system support framing and accessories, shall be designed to provide for such expansion and contraction of component materials as will be caused by temperature changes without causing buckling, stresses on other

cladding components, failure of joints, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other visual or technical detrimental effects.

2.2 METAL ROOF PANELS

A. Manufacturer and Product, or Equal

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal.

a. Centria Architectural Systems; Structural Standing Seam – SRS 3-1.5, 16.

B. Description

1. Metal roof panels shall be 16-inches wide (406 mm), structural standing seam metal roof system with minimum 3-inch (76 mm) high, “T” shaped, vertical seam side joint, mechanically seamed with factory-applied sealant. Provide metal roof panels with longitudinal stiffening planks to minimize the effects of “oil canning.”

2. Metal roof panels shall be fabricated from zinc-coated steel conforming to ASTM A 653 SQ Grade 37 with G90 coating. Material shall be minimum 20-gauge with flat smooth surface texture.

3. Separate panel battens shall be fabricated in the same material, gauge, finish, and length as the panels with factory applied sealant, unless otherwise indicated.

4. Metal roof panel system shall be attached to the system support structure with concealed anchor clips designed to allow for thermal movement of the panels. There shall be no exposed fasteners except at panel fixing locations and flashing details.

5. Continuous preformed closed cell neoprene foam sheet shall be provided to seal between the system support framing and the panel system. Sheets shall be 1/8-inch (3.2-mm) thick by 5-inches (127-mm) wide and continuous.

6. Roll-forming of metal roof panels at the Site shall be performed with Manufacturer-owned and operated industrial type rolling mill having a minimum of 12 stands to gradually shape the sheet metal. Installer-owned or rented roll-formers are not acceptable.

7. Metal roof panels shall be formed by continuous end-rolling method providing uniformity of cross-section across panels.

8. Metal roof panels shall be fabricated in full lengths from ridge to eave without end laps.

9. Metal roof panel battens shall be mechanically seamed with a field-operated electric seaming machine provided by the Manufacturer.

2.3 SOFFIT PANELS

A. Manufacturer and Product, or Equal

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal.

    a. Centria Architectural Systems; Profile IW Series, IW-10A.

B. Description

1. Soffit panels shall be 12-inches wide (305 mm), 1 1/2-inches deep (38 mm), 22-gauge, G90 galvanized steel, with concealed fastener, lock-joint design. Panels shall be flush, flat smooth surface texture, unless otherwise indicated.

    a. Provide ventilated soffit panels, consisting of 10 percent perforated open area, uniformly spaces holes per panel. Ventilated panels shall be provided in sufficient quantities to account for 20 percent of total soffit panel area. Ventilated panels shall be installed uniformly throughout soffit panel distribution area.

    b. Provide non-ventilated soffit panels only where specifically indicated on the Contract Drawings.

2.4 SYSTEM SUPPORT FRAMING

A. General

1. System support framing includes cold-formed metal support framing members, connections, fasteners, and appurtenances required to secure the metal roof and soffit panels and appurtenances to the primary structural members and/or to load bearing elements or substrates. System support framing includes, but is not limited to: metal studs, channels, tubes, angles, posts, girts, sub-girts, rods, or other shapes as required.

2. System support framing sizes, quantities, spacing, profiles, and shapes on the Contract Drawings are for illustrative purposes only. System support framing shall be determined by the metal roof and soffit panel system professional engineer licensed in accordance with local engineering licensing laws.

    a. The design of the system support framing shall maintain the intent of the Contract Drawings (as determined by the Engineer), and in order to maintain the relationship of the metal roof and soffit panels to other building materials as indicated, may require custom fabricated units.

3. Provide minimum 16-gauge steel, conforming to ASTM A 653, Grade A, structural quality, and ASTM A 653 SQ Grade 37, Class G90 galvanizing. Clean and repair galvanizing damaged in field welding or otherwise, using two coats of approved 95 percent zinc dust paint.

4. System support framing shall not vary from the theoretical plane by more than the tolerances below, which are more stringent than AISC tolerances to ensure optimal appearance and performance of the metal panel system.

    a. One fourth-inch in any 20-foot (6.1 m) length vertically or horizontally.

b. Plus or minus 1/2- inch (13 mm) maximum in any building elevation.

c. Plus or minus (+ or -) 1/8-inch (3.2 mm) within 5-feet (1.5 m) of any change in plane such as corners and soffits.

2.5 ACCESSORIES AND APPURTENANCES

A. General

1. Accessories shall be suitable for, and compatible with, the metal roof and soffit panels, system support framing, and with other system accessories and appurtenances.

2. Preformed metal closures, trim pieces, flashings, sheets, clips, and associated appurtenances shall be as indicated or as otherwise required for weather tightness or completeness, and shall be of the same material, color, and finish as the adjacent panels, unless otherwise indicated.

a. The minimum face dimensions between flashing breaks shall be 12-inches (305 mm). Thermal expansion of exposed items more than 24-feet (7.3 m) in continuous length shall be accommodated and watertight expansion joints shall be provided at approved locations.

b. Expansion joints shall be fabricated as approved of materials to match the flashing.

c. Flashing and trim shall be minimum 20-gauge, formed, extruded metal fabricated with the same finish and color as the exterior face of the adjacent panels, unless otherwise indicated.

B. Pre-Engineered Roof Curb

1. Manufacturer and Product, or Equal:

a. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal.

1) Roof Products, Inc.; Structural Roof Curb, Model RPC-3LW

2. Description:

a. Curb dimensions shall be coordinated with the structure and with the pre-engineered removable access cover.

b. Height of curb shall be as required such that curb is not less than 12-inches (305 mm) above top of metal roof panels. The bottom of the curb shall follow the slope of the roof, with the top of the curb providing a horizontal and level surface for installation, connection, and mounting of pre-engineered removable access cover.

c. Roof curbs shall be constructed using a minimum of 14-gauge galvanized steel or heavier gauge material as necessary to meet the requirements indicated with internal reinforcing, mounting flange, and with fully mitered, welded, micro-sealed and prime painted corners.

d. 1/4-inch (6.4 mm) thick by 1-inch (25 mm) wide neoprene gasketing shall be provided for the pre-engineered removable access cover.

C. Vapor Barrier: Shall be 10-mil (0.254-mm) polyethylene sheet, with a vapor transmission rating less than 1.0 perms, per ASTM E 96, Test Method A. Provide with matching tape to seal joints, tears, and penetrations.

D. Roof Underlayment: Shall be one (1) layer of asphalt-saturated, unperforated, 30-lb non-asbestos felt conforming to ASTM D226, Type I.

E. Clips: Concealed anchor clips shall be one piece, 16-gauge, ASTM A 653, G90 galvanized steel, designed to accommodate unlimited, unimpeded panel movement, or 2 piece with 16-gauge G90 galvanized steel top piece and 16-gauge G90 galvanized steel bottom piece designed to accommodate a 3 inch (76 mm) movement range, as determined by the requirements indicated.

F. Fasteners

1. Concealed anchor clip screws shall be minimum No. 14, self-tapping, hex head type, corrosion resistant finish, with 5/8-inch (16 mm) diameter combination steel and neoprene washers.

2. Exposed screws, where allowed, shall be minimum No. 14 diameter, 316 series stainless steel, self-tapping, hex head with 5/8-inch (16 mm) bonded neoprene and 316 series stainless steel washers. Screws and washers shall be coated with finish and color to match the exterior panel color.

3. Concealed screws shall be minimum No. 14, self-tapping, carbon steel with hex head and corrosion resistant coating.

4. Structural bulbed rivets shall be minimum 3/16-inch (4.8-mm) diameter, standard dome head, aluminum rivet and mandrel, with a weather tight EPDM washer under the head. Rivets shall be painted to match panel color.

5. Exposed exterior fasteners and washers shall match the finish and color of trim and panels.

G. Closures: Closures shall be provided as required for a complete system. Closures shall be combination pre-molded, pre-cut, closed-cell foam neoprene and/or sheet metal to fit the contour of the panels. Metal closures shall be fabricated from the same material, gauge, finish, and color as the exterior metal panel. Ridge closures shall be factory fabricated to panel width. Hip closures shall be cut to length in the field.

H. Sealants

1. Factory applied side lap sealant shall be a one part, non-skinning, non-drying, synthetic butyl elastomer.

2. Field applied hidden sealant at side laps, end laps, and flashing details shall be gun grade non-skinning butyl elastomer or polymeric non-skinning butyl tape to ensure weather tightness.

3. Exposed sealant shall be as one-part moisture curing, gun grade polyurethane as recommended in writing by the Manufacturer. Color shall match adjacent panels as approved by Engineer. Provide custom color as required.

I. Thermal Spacers: Thermal spacers shall be composite metal channel with foam insert.

J. Gutters and Downspouts

1. Gutters and downspouts shall be of the profile and configuration indicated, 18-gauge, and of same material, finish, as the metal roofing panels.

   a. The color of gutters and downspouts shall match the adjacent masonry or flashing to which they are fastened, unless otherwise indicated.

   b. Where gutters and downspouts span multiple materials, the portion of the gutter and downspouts shall match each adjacent material respectively.

   c. Gutters and downspouts shall be fabricated with lines and corners of exposed units true and accurate. Exposed faces shall be formed flat and free of buckles, excessive waves and tool marks. Uniform neat seams shall be folded back to form a hem on the concealed side of exposed edges.

   d. Strainer units at the gutter outlets shall be provided from No. 4 stainless steel screen with 0.35 wires.

   e. Gutter covers shall be same material, gauge and color as gutter provided along entire length of gutter.

   f. Adequate fasteners, supports, and straps shall be provided to support the configurations and lengths indicated.

   g. Thermal expansion and contraction of items more than 15-feet (4.6 m) continuous length shall be accommodated and watertight expansion joints shall be provided at approved locations. Expansion joints shall be fabricated of the same materials, finish, and color to match the associated gutter and/or downspout.

   h. Gutters and downspouts shall be designed, fabricated, and installed as indicated, in accordance with Manufacturer's written instructions, and in compliance with SMACNA and NRCA standard practices.

K. Flashing

1. Flashing and penetration details shall be designed, fabricated, and installed as indicated, in accordance with Manufacturer's instructions, and in compliance with SMACNA and NRCA standard roofing practices.

   a. Flashing shall be provided for penetrations. Provide penetration enclosures, including hot pipe penetrations, to be weathertight. Coordinate locations of protruding pipes.

2. Pipe Flashings:

   a. Pipe Flashings shall be pre-molded EPDM rubber with metal collar.

b. Pipe flashing shall be **ITW Buildex; DEKTITE**, or equal.

2.6 FINISH AND COLOR

A. Unless otherwise indicated, interior and exterior panel surfaces, and surfaces of accessories, shall be factory finished consisting of 0.8-mil (0.02 mm) primer with 0.8-mil (0.02 mm), 70 percent **Kynar 500 color coat** and 0.8-mil (0.02 mm), 70 percent or **Kynar 500 clear coat**.

1. Finish shall be Centria Architectural Systems; Duragard Plus 3-coat Coating System, or equal.

2. Finish shall be applied by coil coating the flat stock, primer both sides of panel and all around.

3. Finish shall comply with the following minimum criteria:

Total Coating Thickness (ASTM D 4128-94)	2.4 mils (0.06 mm)
Flexibility (T-Bend) (ASTM D 4145)	1T, no cracking or tape removal of film
Abrasion (ASTM D 968)	290 liters minimum
Humidity (ASTM D 4585)	No color change (1500 hours)
Kesternich (ASTM G 87)	No color change, no blisters (30 cycles)
Salt Fog (ASTM B 117)	No creepage, no blisters in field (1000 hours)

4. Color shall be selected and approved by the Owner from Manufacturer's full color range including custom colors, and may be required to exactly match other building components, as determined by the Owner.

a. Tentative color selection: Color shall exactly match colors indicated below, as selected and approved by the Owner.

Metal Roof Panels	
Exterior:	To Be Selected
Interior:	310 Bone White
Metal soffit panels:	To be Selected
Metal Soffit Panels	
Exterior:	To Be Selected
Interior:	310 Bone White

b. The Owner reserves the option of changing this tentative color selection during the submittal process.

c. Color shall be uniform with no variation in shade, and panels of different color batches will not be acceptable.

2.7 FABRICATION

A. The Contractor shall field verify size, location, and placement of metal roof and soffit panels, system support framing, and appurtenances, shall advise the Engineer in writing of any necessary adjustments, and shall make the necessary adjustments prior to fabrication. The

Contractor shall coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments.

1. Metal roof panels and soffit panels shall be prefabricated in full lengths.

2. Spliced panels will not be accepted.

3. Panels and panel components shall be fabricated in the factory for field assembly to the greatest extent possible.

B. Accurate relation of planes and angles shall be maintained, with hairline fit of contacting members.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

1. Materials shall be delivered to Site in a dry and undamaged condition and unloaded per the Manufacturer's instructions. The installer shall inspect materials for damage and stains upon arrival to the Site.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

1. Storage shall be in a manner that will prevent damage or marring of the finish. Materials shall be stored out of contact with the ground in weathertight coverings to keep them dry per the Manufacturer's recommendations. Storage accommodations shall provide good air circulation and protection from surface staining.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after installation.

B. Protect surrounding Work from damage that may result from operations under this Section.

3.3 INSPECTION

A. The Contractor shall be totally responsible for the proper performance and completion of the Work under this Section.

B. The Contractor shall inspect materials for damage and shall confirm conformance with these Specifications, erection drawings, and Shop Drawings prior to installation.

C. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

2. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units shall be rejected.

D. The Contractor shall verify dimensions, tolerances, and method of attachment with adjacent Work.

1. Examine substrates, areas, and conditions where metal roof and soffit panels, system support framing, and appurtenances will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed metal panels and appurtenances.

a. Provide inserts, backing, blocking, anchoring devices, and reinforcements that must be built into other Work for the installation of metal roof and soffit panels, system support framing, and appurtenances. Coordinate delivery with other Work to avoid delay.

b. Prior to installing the metal roof and soffit panels, the Contractor and the metal panel installer shall verify final alignment of the system support framing to be in compliance with these specifications with the Contract Drawings, with the erection drawings, and with the Shop Drawings.

2. Notify the Engineer in writing of conditions detrimental to the proper and timely completion of the Work Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the Contractor shall indicate Contractor's acceptance of the substrate, areas, and conditions.

E. Metal Roof and Soffit Panels

1. Do not install roofing until the structure is ready for roofing.

a. Supports shall be in place and bracing and connections tightened before Work proceeds.

b. Dimensions and support alignment shall be checked with a taut string or wire. Panel misalignment may induce "oil canning" and potentially restrict panel movement.

1) Panel maximum out-of-plane deviation shall be limited to plus or minus 3/16-inch (4.8 mm) from control.

2) Maximum deviation between adjacent panel clips shall be limited to 1/8-inch (3.2 mm) or L/500, whichever is less.

3.4 PREPARATION

A. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

3.5 INSTALLATION

A. General

1. Installation shall comply with the requirements of the Contract Documents, with applicable references, with NRCA, with the requirements of the Code, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the Engineer.

2. The Contractor shall provide corrosion resistant fasteners, anchors, and shims required for a complete installation, and shall be secure, plumb, level, straight, and true to line, allowing for required movement, including expansion and contraction.

3. The Contractor shall provide separation of dissimilar materials to ensure no galvanic action occurs.

    a. Paint, bituminous coating, or sealant as recommended by the metal panel Manufacturer shall separate dissimilar metals.

4. Horizontal lines shall be level, and vertical lines shall be plumb.

5. Manufacturer shall provide detailed instructions covering the tools, fasteners, sealants, gaskets, and procedures required to assure performance of the metal panel assembly.

6. Work shall be coordinated as required to insure proper flashing and seals to adjoining construction.

7. Install metal roof and soffit panels in one continuous length, without horizontal seams, joints or laps.

8. Install vapor barrier with continuous and overlapping coverage over structural deck; overlap vapor barrier sheets by 6-inch (152 mm) minimum laps. Seal joints and penetrations with compatible vapor barrier tape. Then install roof insulation with continuous coverage over vapor barrier. Then install underlayment and with continuous and overlapping coverage over insulation with laps as required by the Code and by the underlayment Manufacturer. Then install roof panels over underlayment.

B. Roof Panels

1. Install hand-crimp battens at each clip. Panels must be hand-crimped before workers can stand on the panels.

2. Seam panels and battens together with portable electric seaming machine supplied by the Manufacturer.

3. The installer shall provide walk boards in heavy traffic areas to prevent damage to the panels.

3.6 CLEANING, FINISHING, AND PROTECTION

A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of the Contractor.

2. Residue shall not be left on any surfaces.

B. Upon completion of the installation, metal roof and soffit panels and appurtenances shall be cleaned of dirt and other foreign matter to the satisfaction of the Engineer.

1. Cleaning shall be performed again immediately prior to acceptance of the Work, as determined by the Engineer.

2. Cleaning shall be performed in accordance with the Manufacturer's written instructions.

C. Metal roof and soffit panels, accessories and appurtenances, shall be protected from damage from subsequent construction operations.

D. The Contractor shall make adjustments required until accepted.

E. The Contractor shall remove scratches and blemishes to the satisfaction of the Engineer.

F. Damaged or defective items shall be removed and replaced at the direction of the Engineer.

G. When metal roof and soffit panel Work is completed, remove unused materials, containers, and equipment, and clean the Site of metal roof and soffit panel debris.

END OF SECTION

SECTION 07 92 13 – SEALANTS AND CAULKING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sealants and caulking.

B. Related Requirements

1. 01 33 00 – Contractor Submittals
2. 03 32 00 – Joints in Concrete

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. American Society for Testing and Materials (ASTM):

1. ASTM C 920 - Elastomeric Joint Sealants

2. ASTM D 1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

C. Sealant, Waterproofing, and Restoration Institute (SWRI).

1.3 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. The Contractor shall coordinate color samples with other Sections through the submittal process, as required by the Engineer.

1.4 ACTION SUBMITTALS

A. Product Data

1. Manufacturer's specifications, technical data, installation methods, and maintenance instructions, and the following:

2. Joint width and depth tables.

3. Manufacturer's full range color charts, indicating custom color availability, for color selection by Owner.

B. Certifications:

1. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the

project location, date of project completion, and contact information of the consultant firm of record, general contractor and owner.

2. Certification by the Manufacturer's technical field representative that surfaces have been prepared and the products have been applied in accordance with the Manufacturer's recommendations.

3. Certification from an independent testing laboratory that the submitted materials meet the requirements of the references indicated.

C. Application Schedule

1. Furnish a detailed and complete application schedule indicating location and detail of installation.

D. Samples

1. When requested by the Engineer, submit samples of the materials proposed. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by the Engineer. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the Contractor from compliance with the Contract Documents.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility

1. Sealants and Caulking shall be provided by a single Manufacturer, each.

B. Qualifications

1. Manufacturer

a. Sealants and caulking Manufacturer shall have a minimum of 20 years of sealants and caulking manufacturing experience.

2. Installer

a. Installer shall have a minimum of 5 years' experience in the successful completion of at least 5 projects of similar size and scope, employing similar products, materials, applications, and performance requirements.

C. Manufacturer's Technical Field Representative

1. The Contractor shall arrange for a Manufacturer's technical field representative to be on Site for at least 1 day, beginning at the start of surface preparation and continuing through application, to train the installers and to supervise the Work. The Manufacturer's technical field representative shall observe as necessary to certify in writing that the completed Work has been performed according to the Manufacturer's instructions.

D. Sealant and caulking Work shall comply with the following references:

1. SWRI.
2. ASTM C 920.

1.6 WARRANTY

A. Manufacturer

1. Furnish Manufacturer's 5-year written warranty to cover defects in materials, products, and manufacturing workmanship.

B. Special Warranty

1. The Contractor shall furnish separate, but concurrently running, 5-year written warranty to cover labor.

C. Warranties shall be non-prorated for the entire warranty period.

D. The term of the warranties shall begin on the date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL

A. Sealant and caulking, including compressible filler and joint backing, shall be recommended by the Manufacturer for the installation indicated.

B. Sealant and caulking, including compressible filler and joint backing, shall be suitable for, and compatible with, the required installation.

C. Sealant and caulking, including compressible filler and joint backing, shall be suitable for, and compatible with, the substrates and surfaces indicated.

D. Refer to Section 03 32 00 – Joints in Concrete for joint treatment in concrete hydraulic structures.

E. Colors for sealants and caulking above grade and exposed to view shall be selected by the Owner from Manufacturer's full color range, including custom colors.

2.2 INTERIOR AND EXTERIOR SEALANTS (HORIZONTAL OR SLOPED PLANES)

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal:

a. MasterSeal SL2 by BASF, including primer as recommended by Manufacturer.

B. Description: Two part, pour grade polyurethane base, ASTM C 920, Type M, Grade P, Class 25, Use T, NT, M, A, and I.

2.3 INTERIOR AND EXTERIOR SEALANTS (VERTICAL PLANE)

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal:

a. MasterSeal NP2 by BASF, including primer as recommended by Manufacturer.

B. Description: Multi-component, gun grade, polyurethane ASTM C 920, Type M, Grade NS Class 25, Use NT, T, M, A, G, and O.

2.4 COMPRESSIBLE FILLER

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide Manufacturer listed below, or equal:

a. Hohmann & Barnard.

B. Description:

1. Compressible filler shall be an impregnated preformed compressible sealant, produced by combining permanently elastic, high density open cell, polyurethane foam with stabilizing acrylics. Compressible filler shall be supplied pre-compressed in a tape form with a PSA on one side.

2. Compressible filler shall be compatible with sealant Manufacturer's product and shall not stain the sealant nor the materials to which applied.

2.5 JOINT BACKING (BACKER ROD)

A. Description:

1. Joint backing for joints in superstructure shall be approved, resilient, closed cell polyethylene rods of diameters to suit joint conditions. Joint backing shall comply with ASTM D 1752, Type II or III.

2. Where joint depth will not allow for a rod and still provide 3/8-inch (9.5 mm) minimum depth of sealant, provide approved bond breaker tape at the bottom of the joint.

3. Joint backing shall be compatible with sealant Manufacturer's product and shall not stain the sealant nor the materials to which applied.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 APPLICATION SCHEDULE

A. Joints noted as "caulk," "caulking," or "sealant" shall be caulked as specified herein.

B. Joints to be caulked or sealed include through-bolt holes, door frames, louver and ventilator frames, joints between openings where items pass through exterior walls, concrete masonry, or combination of these surfaces, and as otherwise indicated or required for watertightness, weatherproofing, or airtightness.

1. Sealants and caulking shall be provided at both exterior and interior surfaces of exterior wall penetrations.

C. Sealants and caulking shall be provided at exterior wall joints, between adjacent materials, joints between frames or louvers and adjacent materials, copings, caps, sills, masonry control joints, and other joints and penetrations indicated or required for the completion of the Work.

D. Sealants and caulking shall be provided at interior joints between frames and masonry, at tops of masonry walls, between masonry and structural concrete, floor joints in tile, joints in rooms to be airtight, and other joints and penetrations on the Contract Drawings or as required for the completion of the Work.

E. Sealants and caulking shall also be installed elsewhere, where indicated on the Contract Drawings.

3.3 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions, and referenced standards, for environmental conditions before, during, and after installation.

B. Protect surrounding Work from damage that may result from operations under this Section.

3.4 INSPECTION

A. The Contractor shall be totally responsible for the proper performance and completion of the Work under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

C. The Contractor shall verify dimensions, tolerances, and method of attachment with adjacent Work.

1. Examine substrates, areas, and conditions where sealants and caulking will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed sealants and caulking.

a. Surfaces to receive sealants and caulking, including compressible filler and joint backing, shall be dry, free of oil, dirt, dust and other contaminants and loose materials, and shall be in the proper condition as indicated by the Manufacturer prior to the application of the sealant and caulking materials.

b. Masonry, concrete, and cementitious products shall have been completely cured and the surface shall be dry and free from frost at the time of application.

c. Joint shapes and sizes shall be as indicated. Where not indicated, joint shapes and sizes shall be as necessary for job conditions, as directed by the Engineer.

2. Notify the Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the Contractor shall indicate Contractor's acceptance of the substrate, areas, and conditions.

3.5 SURFACE PREPARATION

A. Surface preparation shall be in compliance with the applicable references and with the Manufacturer's written instructions.

B. Coatings, including curing compounds, form release agents, and other substances shall be removed as recommended by the sealant and caulking Manufacturer.

C. Protrusions, bumps, ridges, and loose substrate surface materials shall be removed by sanding or grinding.

D. Laitance, efflorescence, and loose mortar shall be removed from the joint cavity.

E. Ferrous metal surfaces shall be cleaned of rust, mill scale, and other coatings by wire brush, grinding, or sandblasting.

F. Protective coatings shall be removed from surfaces to receive sealants and caulking.

1. Solvents used to remove protective coating shall be as recommended by the sealant and caulking Manufacturer, shall be compatible with the adjacent materials and surfaces, shall not damage adjacent finishes, and shall be non-staining.

G. Bituminous or resinous materials shall be removed from surfaces to receive sealants and caulking.

H. Immediately before application of sealant and caulking materials, scrape surfaces to be covered free from foreign materials and brush clean.

I. Substrate shall be swept to remove all loose materials prior to beginning sealant and caulking installation.

3.6 PREPARATION

A. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

3.7 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with applicable references, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the Engineer.

B. Primer, if recommended by the Manufacturer for the application, shall be applied per the Manufacturer's recommended procedures.

1. Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not be primed.

C. Multi-component sealants shall be mixed according to Manufacturer's printed instructions. Sealant in guns shall be applied with a nozzle of proper size to fit the width of joint. Sealant shall be installed to the required depth without displacing the backing. Unless otherwise indicated or recommended by the Manufacturer, the installed sealant shall be tooled so that the surface is uniformly smooth and free of wrinkles and to assure full adhesion to the sides of the joint. Sealants shall be installed free of air pockets, foreign embedded matter, ridges, and sags. Sealer shall be applied over the sealant if recommended by the sealant Manufacturer.

D. Sealant depth in joints shall be half of the width of joint, but not less than 1/8-inch (3.2 mm) deep and 1/4-inch (6.4 mm) wide nor more than 1/2-inch (12.7 mm) deep and one-inch wide (25.4 mm). For joints greater than 1-inch (25.4 mm) wide, provide sealant in a 2 to 1 width-to-depth ratio.

E. Joints shall have a rigid filler material installed to proper depth prior to application of sealant.

F. Masking film shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking shall be removed as soon as possible after joint has been filled and tooled.

G. Backing shall be installed to provide the indicated sealant depth. The installation tool shall be shaped to avoid puncturing the backing.

H. Bond-breaker shall be applied to fully cover the bottom of the joint without contaminating the sides where sealant adhesion is required.

I. A full bead of sealant shall be applied into the joint under sufficient pressure, with the nozzle drawn across sealant, to completely fill the void space and to ensure complete wetting of contact area to obtain uniform adhesion. During application, the tip of the nozzle shall be kept at the bottom of the joint thereby forcing the sealant to fill from the bottom to the top. Sealants shall be tooled immediately after exposure with a caulking tool or soft bristled brush moistened

with solvent. The finished sealant-filled joint shall be slightly concave unless otherwise indicated.

3.8 CLEANING, FINISHING, AND PROTECTION

A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of the Contractor.

2. Residue shall not be left on any surfaces.

3. The surfaces of materials adjoining caulked joints shall be cleaned free of smears of sealant or other soiling due to caulking operations.

B. Sealants and caulking shall be protected from damage from subsequent construction operations.

C. The Contractors shall make adjustments required until accepted.

D. Damaged or defective items shall be removed and replaced at the direction of the Engineer.

E. When sealant and caulking Work is completed, remove unused materials, containers, and equipment, and clean the Site of sealant and caulking debris.

END OF SECTION

SECTION 08 11 13 – STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide steel doors and frames and appurtenant WORK, complete, in place, and operational in accordance with the Contract Documents.

B. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. American Society for Testing and Materials (ASTM):

ASTM A 153	Zinc Coating (Hot Dip) on Iron and Steel Hardware
ASTM A 653	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

C. American National Standards Institute (ANSI) / Steel Door Institute (SDI):

ANSI A 115	Specification for Preparation of Steel Doors and Frames for Hardware
ANSI/SDI A 250.6	Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
ANSI A 250.8/SDI 100	Recommended Specifications for Standard Steel Doors and Frames

D. Building Code: Refer to the Drawings to determine which Building Code applies. The applicable Building Code, defined by the Drawings, is referred to herein as “the CODE.”

E. National Fire Protection Association (NFPA):

NFPA 80	Fire Doors and Windows

F. Steel Door Institute (SDI): Recommended Locations for Builders’ Hardware for Standards Steel Doors and Frames

G. Uniform Building Code (UBC):

UBC 7-2	Fire Tests of Door Assemblies

H. Underwriters’ Laboratories (UL):

UL 10	Standard for Fire Test Door and Assemblies
UL 10C	Positive Pressure Fire Tests of Door Assemblies

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Literature: Manufacturer's specifications, technical data, installation methods, and maintenance instructions.

C. Certifications:

1. Certification of compliance with the requirements of paragraph 2.1.A.

2. Certification of Manufacturer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, Manufacturer's products, and contact information of the consultant firm of record, general contractor and owner.

3. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, and contact information of the consultant firm of record, general contractor and owner.

4. Submit certification from a recognized testing agency that fire doors have passed tests to meet fire ratings indicated.

5. Certification from the Manufacturer stating that galvanizing has been completed in accordance with these specifications.

6. Certification from the Manufacturer stating that the rust-inhibitive primer is compatible with painting systems in Section 09 96 00 – Protective Coatings.

7. When requested by the ENGINEER, furnish other certifications as may be required to demonstrate compliance with the Contract Documents.

D. Shop Drawings: Complete Shop Drawings showing location and detail of installation.

1. Shop Drawings shall be drawn to sufficient scale and shall include dimensions, show elevations and details of construction of each door and frame type, schedule of doors and frames, frame elevations and details, location and installation requirements for hardware, thickness of materials, joints, provisions for expansion and contraction, connections, accessories, and trim. Shop Drawings shall show installation conditions at openings with various wall thickness and materials.

2. Include details of core and edge construction, through-door louvers, vision panels, and trim for openings.

E. Samples: The CONTRACTOR shall submit 2 samples of each of the following. Unless otherwise indicated, samples shall be full size and shall show gauges, configuration, construction, finish and color proposed for the various components. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by the ENGINEER. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and

quality of each item. Approval of samples shall not relieve the CONTRACTOR from compliance with the Contract Documents.

1. 6-inches (152 mm) by 6-inches (152 mm) frame corner construction, including galvanizing, welding, grinding, touch-up, and priming.

2. 6-inches (152 mm) by 6-inches (152 mm) door panel construction, including galvanizing, welding, grinding, touch-up, and priming.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Steel doors and frames shall be provided by a single Manufacturer.

B. Steel doors and frames shall conform to ANSI A 250.8/SDI 100, except where more stringent requirements are indicated herein.

C. Fire Rated Openings:

1. Steel doors and frames required to be fire-rated shall bear UL labels indicating the applicable fire ratings. Designs and construction of such products shall have specific UL approval according to current procedures for the fire rating. Assemblies shall be constructed to comply with NFPA 80, with the CODE, and with other requirements indicated.

2. Steel doors and frame assemblies and components shall be compliant with positive pressure and S-label requirements. Steel doors and frames shall be coordinated with door hardware supplier to ensure that total opening installation is compatible with UL 10C and UBC 7-2.

PART 2 PRODUCTS

2.1 GENERAL

A. Structural Requirements:

1. Steel doors and frames, including related assemblies, components, and attachment details shall comply with the CODE and shall be designed and installed for resistance to the structural design criteria indicated in the Contract Documents in accordance with the CODE. Where a conflict occurs between the requirements of this Section and the CODE, the more stringent shall apply.

a. Refer to Section 01 33 17 – Structural Design, Support and Anchorage for additional design criteria.

2. The CONTRACTOR shall provide additional non-standard bracing, reinforcements, anchors, and heavier gauge materials if required to conform to the structural design criteria indicated and to other performance requirements indicated.

B. Refer to Section 08 71 00 – Door Hardware, for door hardware to be provided for Steel Doors and Frames.

2.2 STEEL DOORS

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide Manufacturer and product listed below:

a. Curries Co., (ASSA ABLOY Group); 747 Series modified by the Manufacturer with custom upgraded features as required to comply with the Specifications.

b. Steelcraft

c. Pioneer

d. Ceco

B. Description:

1. Provide flush design steel doors, 1 ¾-inch (45 mm) thick, seamless hollow construction, unless otherwise indicated.

2. Exterior Doors: 14-gauge galvanized sheet steel, SDI Level 4 Classification

3. Interior Doors: 16-gauge galvanized sheet steel, SDI Level 3-Model; 2 Classification

4. Galvanized steel sheets shall be zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 653, G90 zinc coating, mill phosphatized.

5. For single-acting swing doors, vertical edge at lock edge shall be beveled 1/8-inch (3.2 mm) in 2-inches (51 mm).

6. Doors shall be fabricated of 2 outer, galvanized, stretcher-leveled steel sheets not less than 16-gauge. Doors shall be constructed with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges. Weep hole openings shall be provided in the bottom of doors to permit escape of entrapped moisture.

7. Inside of doors shall be reinforced with vertical galvanized sheet steel Sections not less than 22-gauge. Vertical reinforcing shall be spaced 6-inches (152 mm) on center and extend full door height. Spot-weld at not more than 5-inches (127 mm) on center to both face sheets.

8. Insulate spaces between door ribs with one pound, nominal density fiberglass insulation. R-value of door shall be at least 2.78 hr/Btu/sq. ft./deg F.

9. Tops and bottoms of doors shall be reinforced with 16-gauge horizontal steel channels welded continuously to outer sheets. Top and bottom edges shall be closed to provide seal, as integral part of door construction while providing recesses for required hardware and appurtenances.

C. Through-Door Louvers: Provide through-door louvers of sizes indicated or required. Louvers shall be 18-gauge, cold-rolled galvanized steel sheet matching the doors. Fabricate units with stationary, sight-proof blades and channel shaped frames, not less than 1-inch (25.4 mm) deep. Space louver blades not more than 3/4-inches (19 mm) on center. Assemble units by welding.

D. Door Hardware Reinforcement:

1. Components shall be reinforced for hardware installation in accordance with ANSI/SDI A 250.6.

a. Lock and closer reinforcements shall be “box” or “channel” type.

b. Punch single leaf frames to receive 3 silencers. Double leaf frames shall receive one silencer per leaf at head.

c. Factory prepared hardware locations shall be in accordance with “Recommended Locations for Builders' Hardware for Standard Steel Doors and Frames,” as adopted by SDI.

d. Supply welded in mortar guards at hardware cutouts in frames built into masonry or grouted in full.

2.3 STEEL FRAMES

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal:

a. Curries Co., (ASSA ABLOY Group); Masonry/Flush Frame M Type (Equal Rabbet).

B. Description:

1. Provide hollow metal frames for doors, windows, lites, cased openings, and for other openings where indicated. Frames shall be 14-gauge galvanized sheet steel, 5 ¾- inches (146 mm) wide by 2-inches (51 mm) deep, unless otherwise indicated.

a. Stops shall be formed integral with the frame unless otherwise indicated.

b. Provide removable stops where indicated or required on secured room side of opening, formed of not less than 18-gauge steel sheets. Secure with oval head machine screws spaced uniformly not more than 12-inches (305 mm) on center. Form corners with butted hairline joints.

1) Coordinate width of rabbet between fixed and removable stops with type of glass, panel, and type of installation indicated.

c. Galvanized steel sheets shall be zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 653, G90 zinc coating, mill phosphatized.

2. Frames shall be fabricated of welded unit construction, with corners mitered, reinforced, and face welded. No field-spliced frames will be allowed.

3. Frames set in masonry walls are shall be face-welded and ground smooth and re-primed at the welded area.

4. Provide temporary shipping bars to help protect from damage during transit and handling.

5. Temporary shipping bars shall be removed before setting frames.

6. Welds on frames shall be flush with neatly mitered or butted material cuts.

7. Frames shall be pretreated prior to priming at factory by washing, phosphatizing and by chromic seal. Primer shall be baked on.

C. Jamb Anchors:

1. Masonry construction: Adjustable, flat, corrugated or perforated 'T' shaped with leg not less than 2-inches wide (51 mm) by 10-inches (254 mm) long or masonry “wire” type not less than 3/16-inch (4.8 mm) diameter.

    a. Provide at least 3 anchors equally spaced per jamb up to 7-feet 6-inches (2.3 m) in height. Provide 4 anchors equally spaced per jamb up to 8-feet (2.4 m) in height, and one additional anchor equally spaced per jamb for each 24-inches (.61 m) or fraction thereof over 8-feet (2.4 m) in height.

2. In-place masonry or concrete construction: Anchor frame jambs with minimum 3/8-inch (9.5 mm) countersunk flat head stove bolt and expansion shields 6-inches (152 mm) from top and bottom and 26-inches (660 mm) on center, unless otherwise indicated.

    a. Reinforce frames at anchor locations.

        1) Weld pipe spacers, or similar type spacers, per Manufacturer's standard design in back of frame soffit to protect frame profile during tightening of bolts and anchors.

    b. Apply removable stop to cover anchor bolts where indicated.

3. Provide UL approved fixed anchors at fire rated openings.

D. Floor Anchors: Angle clip type.

1. 16-gauge minimum.
2. 2 fasteners per jamb.
3. Welded to the bottom of each jamb.

E. Preparation for Hardware:

1. Reinforcement: Components shall be reinforced for hardware installation in accord with ANSI/SDI A250.6.

2. Lock and closer reinforcements shall be “box” or “channel” type.

3. Punch single leaf frames to receive 3 silencers. Double leaf frames shall receive one silencer per leaf at head.

4. Factory prepared hardware locations shall be in accordance with “Recommended Locations for Builders' Hardware for Standard Steel Doors and Frames,” as adopted by the SDI.

5. Supply welded in mortar guards at hardware cutouts in frames built into masonry or grouted in full.

F. Head Reinforcing: For frames over 4-feet zero-inches (1.2 m) wide in masonry wall openings, provide continuous steel channel or angle stiffener, not less than 12-gauge for full width of opening, welded to back of frame at head.

G. Spreader Bars: Provide removable spreader bar across bottom of frames, tack welded to jambs.

H. Plaster Guards: Provide 26-gauge galvanized steel plaster guards or dust cover boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware installation.

2.4 FABRICATION

A. The CONTRACTOR shall field verify size, location, and placement of doors and frames, shall advise the ENGINEER in writing of any necessary adjustments, and shall make the necessary adjustments prior to fabrication. The CONTRACTOR shall coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments.

B. Doors and frames shall be fabricated to be rigid, neat in appearance, and free from defects, including warping, cupping, buckling, or other defects. Metal shall be accurately formed to required sizes and profiles.

C. Doors and frames shall be fit and assembled in the Manufacturer's plant. Weld exposed joints continuously; grind, dress, and make smooth, flush, and invisible. Metallic filler to conceal manufacturing defects is not acceptable.

D. Doors and frames shall be prepared to receive mortised and concealed door hardware, including cutouts, reinforcing, drilling, and tapping in accordance with final Door Hardware Schedule and templates provided by hardware supplier, and as indicated in the Contract Documents.

1. Comply with applicable requirements of ANSI A 115 for preparation for hardware on doors and frames.

2. Include thru-bolting holes as required per hardware template.

3. Do not include unnecessary cutouts in door faces not required by hardware template.

4. Doors and frames shall be reinforced to receive surface-applied hardware. Drilling and tapping for surface-applied door hardware may be done at Site.

E. Shop Surface Preparation and Priming:

1. Steel surfaces shall be cleaned of dust, dirt, mill scale, rust, oil, grease, and other foreign materials.

a. Zinc-rich primer shall be applied to damaged galvanized surfaces.

2. Pretreatment shall be applied to cleaned metal surfaces, using cold phosphate solution or hot phosphate solution.

3. One full shop coat of rust-inhibitive primer shall be applied within time limits recommended by pretreatment Manufacturer. A smooth coat of even consistency shall be applied to provide a uniform dry film thickness of not less than 2.0-mils (.05 mm).

F. Zinc-Rich Touch-up Primer: Use 95 percent metallic zinc dust primer in a vehicle compatible with the epoxy painting systems in Section 09 96 00 – Protective Coatings.

G. Supports and Anchors: Fabricate of not less than 16-gauge sheet metal. Galvanize after fabrication units complying with ASTM A 153, Class B.

H. Inserts, Bolts, and Fasteners: Hot-dip galvanize, complying with ASTM A 153, Class C or D, as applicable.

I. Rust-Inhibitive Primer:

1. Air-drying or baking type compatible with epoxy finish paint in Section 09 96 00 – Protective Coatings.

2. Provide non-standard primer if required to obtain compatibility.

J. Steel doors and frames shall be field painted per Section 09 96 00 – Protective Coatings.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

1. Steel doors and frames shall be shipped and stored with temporary stiffeners and spacers in place to prevent distortion.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after installation.

B. Protect surrounding WORK from damage that may result from operations under this Section.

3.3 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

2. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units shall be rejected.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where doors and frames will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed doors and frames.

a. Provide inserts, backing, blocking, anchoring devices, and reinforcements that must be built into other WORK for the installation of steel doors and frames. Coordinate delivery with other WORK to avoid delay.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate CONTRACTOR's acceptance of the substrate, areas, and conditions.

3.4 PREPARATION

A. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

3.5 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with applicable references, with the requirements of the CODE, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the ENGINEER.

B. The CONTRACTOR shall provide corrosion resistant fasteners, anchors, and shims required for a complete installation, and shall be secure, plumb, level, straight, and true to line, allowing for required movement, including expansion and contraction.

C. The CONTRACTOR shall provide separation of dissimilar materials to ensure no galvanic action occurs.

D. The CONTRACTOR shall block and reinforce walls as required to support the Steel Doors and Frames and appurtenances.

E. Setting Masonry Anchorage Devices: Provide masonry anchorage devices where required for securing frames to in-place concrete or to existing masonry construction. Set anchorage devices opposite each anchor location, in accordance with details on Shop Drawings and anchorage device Manufacturer's instructions. Drilled holes shall be left rough, not reamed and free from dust and debris.

F. Placing Frames: Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.

G. In new masonry construction, coordinate frame setting with and prior to the building of masonry walls. Provide the required anchors for building in place.

H. At in-place concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage devices.

I. Remove spreader bars only after frames or bucks have been properly set and secured.

3.6 CLEANING, FINISHING, AND PROTECTION

A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of the CONTRACTOR.

2. Residue shall not be left on any surfaces.

B. Upon completion of the installation, doors and frames and appurtenances shall be cleaned of dirt and other foreign matter to the satisfaction of the ENGINEER.

1. Cleaning shall be performed again immediately prior to acceptance of the WORK, when directed by the ENGINEER.

2. Cleaning shall be performed in accordance with the Manufacturer's written instructions.

C. Adjusting and cleaning shall consist of ensuring smooth operation, lubricating and testing the doors and frames.

1. Doors and frames shall operate smoothly, quietly, and without squeaking and binding.

D. Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

E. Doors and frames shall be protected from damage from subsequent construction operations.

F. The CONTRACTOR shall make adjustments required and retest until accepted.

G. The CONTRACTOR shall remove scratches and blemishes to the satisfaction of the ENGINEER.

H. Damaged or defective items shall be removed and replaced at the direction of the ENGINEER.

1. Remove and replace defective WORK, including doors or frames that are warped, bowed, or otherwise unacceptable.

I. When door and frame WORK is completed, remove unused materials, containers, and equipment, and clean the Site of door and frame debris.

END OF SECTION

SECTION 08 33 00 – OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide overhead coiling doors and appurtenant WORK, complete, in place, and operational in accordance with the Contract Documents.

B. The CONTRACTOR shall furnish professional design and engineering services as required for overhead coiling doors.

1. Professional design and engineering services may be provided by the Manufacturer or by an independent licensed civil engineer retained by the CONTRACTOR, either of which shall comply with the requirements indicated.

C. The CONTRACTOR shall coordinate color samples with other Sections through the submittal process.

D. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. American Society for Testing and Materials (ASTM):

ASTM A 123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 653 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

ASTM D 3363 Standard Test Method for Film Hardness by Pencil Test.

C. Building Code: Refer to the Drawings to determine which Building Code applies. The applicable Building Code, defined by the Drawings, is referenced herein as “the CODE.”

D. National Electrical Manufacturer’s Association (NEMA):

1. NEMA Standard KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

a. NEMA 4X – Enclosures intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water.

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Literature: Manufacturer's specifications, technical data, installation methods, and maintenance instructions, and the following:

1. Complete operation instructions.

2. Manufacturer's full-range color charts, indicating custom color availability for color selection by the OWNER.

C. Warranty: Submit a copy of the warranty.

D. Certifications:

1. Certification by the overhead coiling door Manufacturer that the overhead coiling doors provided are suitable for, and compatible with, the required installation.

2. When requested by the ENGINEER, furnish other certifications as may be required to show compliance with the Contract Documents.

E. Shop Drawings and Calculations: Complete Shop Drawings showing location and detail of installation, and design calculations.

1. Shop Drawings and Calculations shall be prepared, approved, and stamped by a professional structural engineer licensed per local engineering laws.

2. Shop Drawings shall be drawn to sufficient scale and shall include dimensions, show elevations and details of construction of each overhead coiling door type, schedule of overhead coiling doors, location and installation requirements for hardware, thickness of materials, joints, provisions for expansion and contraction, connections, accessories, and trim. Shop Drawings shall show installation conditions at openings with various wall thickness and materials.

a. Shop Drawings shall include material descriptions, door guides, finish, color, details of construction, installation, accessories, and operation of each overhead coiling door type.

F. Samples: The CONTRACTOR shall submit 2 samples of each of the following. Unless otherwise indicated, samples shall be full size and shall show gauges, configuration, construction, finish and color proposed for the various components. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by the ENGINEER. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the CONTRACTOR from compliance with the Contract Documents.

1. 3-inches (76 mm) by 4-inches (102 mm) color samples showing substrate, finish, and color.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Overhead coiling doors shall be provided by a single Manufacturer.

B. Manufacturer Qualifications:

1. Overhead coiling doors Manufacturer shall have a minimum of 5 similar successful projects over the most recent 10 years, employing similar products, materials, applications, and performance requirements.

C. Installer Qualifications:

1. Installer shall be trained, certified, and authorized by the Manufacturer to install the Manufacturer's product.

1.5 SPECIAL WARRANTY PROVISIONS

A. For overhead coiling door and appurtenances furnish Manufacturer's 2-year written warranty to cover defects in materials, products, and manufacturing workmanship.

B. The CONTRACTOR shall furnish separate, but concurrently running, 2-year written warranty to cover labor.

C. Warranties shall be non-prorated for the entire warranty period.

D. The term of the warranties shall begin on the date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL

A. Structural Requirements:

1. Overhead coiling doors, including related assemblies, components, and attachment details shall comply with the CODE and shall be designed and installed for resistance to the structural design criteria indicated in the Contract Documents in accordance with the CODE. Where a conflict occurs between the requirements of this Section and the CODE, the more stringent shall apply.

2. The CONTRACTOR shall provide additional non-standard bracing, reinforcements, anchors, and heavier gauge materials in order to conform to the structural design criteria indicated and to other performance requirements indicated.

2.2 OVERHEAD COILING DOORS

A. Manufacturers and Products:

1. Subject to the requirements indicated, provide Manufacturer and product listed below.

a. Cornell Iron Works, Inc.; Thermiser ESD20-6F – With Additional Options and Custom Features as specified herein.

b. The Cookson Company; Temp-Pro Rolling Service Door.

c. Wayne Dalton; Thermotite Model 800C

B. Description:

1. Overhead coiling doors shall be insulated slat, interior mounted, motor operated with chain-hoist override, with factory applied finish and color as indicated.

a. Steel Doors: Interlocking slats of galvanized steel skins conforming to Grade 40 galvanized steel zinc coating, in accordance with ASTM A 653. Each slat shall be formed of exterior 20-gauge, interior 24-gauge, galvanized steel sheets.

2. Fabricate interlocking sections with end-locks on slats to maintain slat alignment, prevent wear, and to comply with requirements.

C. Insulation:

1. 7/8-inch (22 mm) foamed in placed, closed cell polyurethane insulation enclosed in each slat.

2. Total slat R-value: 8.0 hr/Btu/sq ft/deg F minimum.

D. Bottom Bar:

1. Reinforced extruded aluminum interior face with full depth insulation and exterior skin slat to match curtain material and gauge.

2. Finish and color of interior and exterior surfaces shall match slats.

3. Provide with Manufacturer’s standard cylinder lock option.

E. Guides:

1. Minimum of 3/16-inch (4.8 mm) galvanized structural steel and with sufficient depth to retain the curtains in the guides against the design loads. Provide aluminum guides for aluminum doors.

2. When wind-locks are necessary in order to comply with the requirements, provide wind-lock bars of same material as the guides.

3. Provide removable guide stoppers to prevent over-travel of curtain and bottom bar.

4. For steel door guides only – Top 16 1/2-inches (42 cm) of coil side guide angles shall be removable for ease of door installation and as needed for future door service.

5. Provide wind-locks of same material to comply with requirements.

6. Provide a padlockable chain keeper on guide.

F. Counterbalance, Brackets, and Hood:

1. Fabricated in accordance with the Manufacturer's standard practice.

2. The coil shall be housed in a 24-gauge galvanized steel sheet metal hood with reinforced top and bottom edges.

3. Provide minimum 1/4-inch (6 mm) steel intermediate-support brackets as required to prevent excessive sag.

4. Finish shall match the slats.

G. Weatherstripping:

1. Bottom bar: At motor operated doors, provide weatherseal with sensing feature, neoprene extending full width of door.

2. Guides: Provide replaceable vinyl strip sealing against fascia side of door.

3. Lintel: provide nylon brush seal fitted at door header to impede airflow.

4. Hood: provide neoprene / rayon baffle to impede airflow above coil.

H. Locking: Pad-lockable slide bolt on fascia side of bottom bar at each jamb extending into slots in guides.

2.3 FINISH AND COLOR

A. Steel Components:

1. Galvanizing:

a. Sheet steel shall be provided with a zinc coating at not less than 0.90-oz/sq-ft of steel and in a manner as to provide a ductile coating, tightly adhered to base metal and conforming to bond tests converted in accordance with ASTM A 653.

b. Structural shapes and similar heavy steel shall be hot-dipped galvanized per ASTM A 123 and ASTM A 153, as applicable. Provide phosphate coating for paint adhesion at the factory.

B. Steel Door Finish:

1. Provide Manufacturer's fusion bonded thermosetting powder cost finish applied to a minimum 2.5 mils (.0025 inches) cured film thickness.

2. Pencil hardness to be rated H or better per ASTM D 3363.

C. Color:

1. Color shall be selected and approved by the OWNER from Manufacturer's full color range including custom colors, and may be required to exactly match other building components, as determined by the OWNER.

a. Tentative color selection: To be Selected.

1) The OWNER reserves the option of changing this tentative color selection during the submittal process.

2.4 OPERATION

A. General:

1. Provide UL listed electric door operator assembly of the size and capacity recommended in writing by the door Manufacturer; complete with electric motor and factory-prewired motor controls, worm-gear reduction unit, solenoid operated brake, clutch, and control station.

2. Provide auxiliary reduced drive chain hoist with electrically interlocked floor level disconnect for manual operation. Hoist wheel shall be easily moveable to right or left hand side of the unit.

B. Electric Door Operators (Basis of Design: Chamberlain Liftmaster, Model GH with options and custom features as specified herein.)

1. Provide 460-volt, 3-phase motors NEMA 4X rated. Motors shall be high starting torque, continuous duty, industrial type, protected against overload by a current sensing or thermal overload device. Speed reduction shall be worm-gear-in-oil-bath gear reducer with synthetic “All Climate” oil. Door drive shall utilize minimum #50 roller chain and sprockets.

2. Operator shall be equipped with an electrically interlocked floor level disconnect and chain hoist for manual operation and an electric solenoid-actuated brake to stop the motor and hold the door in position.

3. Operator shall be capable of driving the door at a speed of 8 to 9 inches (203 to 229 mm) per second (20 to 23 cm/sec). Fully adjustable, driven linear type limit switch mechanism shall synchronize the operator with the door. Low friction nylon limit nuts fitted on threaded steel shaft, rotating on iolite self-lubricating bronze bushings.

4. The motor shall be removable without affecting the limit switch settings.

5. Coordinate wiring requirements and current characteristics of motors with the building electrical system; see Division 16 Sections of these specifications.

C. Remote Control Station:

1. Provide momentary-contact, 3-button control stations with push button controls labeled “open,” “close,” and “stop.” Install at location as shown, scheduled, or as directed by the ENGINEER.

2. Provide interior units full-guarded type, surface-mounted, heavy-duty, weatherproof, NEMA 4X enclosures.

D. Weather/Sensing Edge:

1. Provide automatic reversing control by an automatic sensing switch within neoprene or rubber astragal extending full width of door bottom bar. Contact before door fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position. Provide retracting safety cord and reel connection to control circuit.

2.5 FABRICATION

A. The CONTRACTOR shall field verify size, location, and placement of overhead coiling doors, shall advise the ENGINEER in writing of any necessary adjustments, and shall make the necessary adjustments prior to fabrication. The CONTRACTOR shall coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments.

1. Overhead coiling doors shall be assembled before shipment to the Site.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after installation.

B. Protect surrounding WORK from damage that may result from operations under this Section.

3.3 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

2. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units shall be rejected.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where doors and appurtenances will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed doors and appurtenances.

a. Provide inserts, backing, blocking, anchoring devices, and reinforcements that must be built into other WORK for the installation of overhead coiling doors. Coordinate delivery with other WORK to avoid delay.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate CONTRACTOR'S acceptance of the substrate, areas, and conditions.

3.4 PREPARATION

A. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

3.5 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with applicable references, with the requirements of the CODE, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the ENGINEER.

B. The CONTRACTOR shall provide corrosion resistant fasteners, anchors, and shims required for a complete installation, and shall be secure, plumb, level, straight, and true to line, allowing for required movement, including expansion and contraction.

C. The CONTRACTOR shall provide separation of dissimilar materials to ensure no galvanic action occurs.

D. The CONTRACTOR shall block and reinforce walls as required to support the overhead coiling doors and appurtenances.

E. Horizontal lines shall be level, and vertical lines shall be plumb.

F. Anchors for guides, brackets, and other fasteners shall be provided as required.

3.6 CLEANING, FINISHING, AND PROTECTION

A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of the CONTRACTOR.

2. Residue shall not be left on any surfaces.

B. Upon completion of the installation, overhead coiling doors and appurtenances shall be cleaned of dirt and other foreign matter to the satisfaction of the ENGINEER.

1. Cleaning shall be performed again immediately prior to acceptance of the WORK, when directed by the ENGINEER.

2. Cleaning shall be performed in accordance with the Manufacturer's written instructions.

C. Adjusting and cleaning shall consist of ensuring smooth operation, lubricating and testing the overhead coiling doors and appurtenances.

1. Overhead coiling doors shall operate smoothly, quietly, and without squeaking and binding.

D. Overhead coiling doors shall be protected from damage from subsequent construction operations.

E. The CONTRACTOR shall make adjustments required and retest until accepted.

F. The CONTRACTOR shall remove scratches and blemishes to the satisfaction of the ENGINEER.

G. Damaged or defective items shall be removed and replaced at the direction of the ENGINEER.

H. When overhead coiling doors WORK is completed, remove unused materials, containers, and equipment, and clean the Site of overhead coiling doors debris.

END OF SECTION

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SECTION 08 51 13 – ALUMINUM WINDOWS

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide aluminum windows and appurtenant Work, complete and in place, in accordance with the Contract Documents.

B. The CONTRACTOR shall furnish professional design and engineering services as required for aluminum windows.

1. Professional design and engineering services may be provided by the manufacturer or by an independent licensed civil engineer retained by the CONTRACTOR, either of which shall comply with the requirements indicated.

C. CONTRACTOR shall coordinate color samples with other Sections through the submittal process.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. American Architectural Manufacturer's Association (AAMA):

AAMA 2605 Voluntary Specification, Performance Requirements, and Testing Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

AAMA 1503 Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

C. American National Standards Institute (ANSI):

ANSI A 117.1 Accessible and Useable Buildings and Facilities

D. American Society for Testing and Materials (ASTM):

ASTM A 36 Structural Steel

ASTM B 209 Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes

ASTM B 308 Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded

ASTM C 509 Cellular Elastomeric Pre-formed Gasket and Sealing Material

ASTM C 864 Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spacers

ASTM E 283 Standard Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen

ASTM E 330 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference

ASTM E 331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

E. American Welding Society (AWS).

F. Building Code: Refer to the Drawings to determine which Building Code applies. The applicable Building Code, defined by the Drawings, is referenced herein as the CODE.

G. Federal Specification (FS):

FS TT-P-645 Primer, Paint, Zinc Chromate, Alkyd Type

H. Society for Protective Coatings (SSPC):

SSPC Paint 12 Cold-Applied Asphalt Mastic (Extra Thick Film)

I. Flat Glass Marketing Association (FGMA) Glazing Manual.

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Literature: Manufacturer's specifications, technical data, installation methods, and maintenance instructions, and the following:

1. Manufacturer's full-range color charts, indicating custom color availability for color selection by the OWNER.

C. Warranty: Submit a copy of the warranty.

D. Certifications:

1. Certification of compliance with the requirements of paragraph 2.1.A.

2. Certified copies of recent test reports of systems similar to the design for this project substantiating performance of system in lieu of re-testing. Other supportive data shall be included as necessary.

3. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of five (5) similar completed projects with addresses of the project location, date of project completion, and contact information of the consultant firm of record, general CONTRACTOR, and owner.

E. Shop Drawings and Calculations: Complete Shop Drawings showing location and detail of installation, and design calculations.

1. Shop Drawings and Calculations shall be prepared, approved, and stamped by a professional civil engineer licensed per local engineering licensing laws.

2. Shop Drawings shall be drawn to sufficient scale and shall include dimensions, show elevations and details of construction of each window frame type, schedule of window frames, frame elevations and details, location and installation requirements for hardware, thickness of materials, joints, provisions for expansion and contraction, connections, accessories, and trim. Shop Drawings shall show installation conditions at openings with various wall thickness and materials.

a. Shop Drawings shall include material descriptions, finish, color, details of construction, installation, and accessories of each aluminum window type.

b. Shop Drawings shall include thermal breaks, details of special shapes, location and types of exposed fasteners and joints, and joint sealant.

c. Shop Drawings shall indicate typical glazing details, locations of various types and thickness of glazing, and internal sealant requirements and details as recommended by the glazing sealant manufacturer.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Aluminum windows shall be provided by a single manufacturer.

B. Manufacturer Qualifications:

1. Aluminum window manufacturer shall have a minimum of five (5) similar successful projects over the most recent 10 years, employing similar products, materials, applications, and performance requirements.

C. Installer Qualifications:

1. Installer shall have a minimum of five (5) years' experience in the successful completion of at least five (5) projects of similar size and scope, employing similar products, materials, applications, and performance requirements.

D. A professional civil engineer licensed per local engineering licensing laws shall design the aluminum windows and connections to the structure.

E. Installation shall be in accordance with the AAMA "Metal Curtain Wall, Window, Storefront and Entrance Guide Specification Manual," the SFM-1 "Aluminum Storefront and Entrance Manual," and other applicable references and with manufacturer's written instructions.

F. Testing Requirements: Components shall be provided that have been previously tested by an independent testing laboratory.

G. Welding shall be performed by AWS qualified welders.

H. In addition to requirements indicated, CONTRACTOR shall comply with applicable provisions of the Aluminum Curtain Wall Design Guide Manual for design, materials, fabrication, and installation of component parts.

1.1 SPECIAL WARRANTY PROVISIONS

I. Furnish manufacturer's 2-year written warranty to cover defects in materials, products, and manufacturing workmanship.

J. Furnish manufacturer's extended 20-year warranty to cover the finish.

1. Warranty shall include provisions for failures of the finish including, but not limited to, chalking, crazing, peeling, and fading.

K. The CONTRACTOR shall furnish separate, but concurrently running, 5-year written warranty to cover labor.

L. Warranties shall be non-prorated for the entire warranty period.

M. The term of the warranties shall begin on the date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Structural Requirements:

1. Aluminum windows, including related assemblies, components, and attachment details shall comply with the CODE and shall be designed and installed for resistance to the structural design criteria indicated in the Contract Documents in accordance with the CODE. Where a conflict occurs between the requirements of this Section and the CODE, the more stringent shall apply.

a. Refer to Section 01 33 17 – Structural Design, Support and Anchorage for additional design criteria.

2. The CONTRACTOR shall provide additional non-standard bracing, reinforcements, anchors, and heavier gauge materials in order to conform to the structural design criteria indicated and to other performance requirements indicated.

B. Aluminum windows shall be recommended by the manufacturer for the installation indicated.

C. Aluminum windows shall be suitable for, and compatible with, the required installation.

D. Design Requirements:

1. Supports, anchorage, and accessories shall be provided as required for complete assembly.

2. Aluminum window system manufacturer shall furnish the systems herein, including necessary modifications to meet the indicated requirements and to maintain visual design concepts as approved by the ENGINEER.

3. Perimeter conditions shall allow for installation tolerances, expansion and contraction of adjacent materials, and sealant manufacturer's recommended joint design.

4. CONTRACTOR shall not assume glazing, sealant and interior finishes contribute to framing member strength, stiffness, or lateral stability.

5. Assemblies shall be free from vibration harmonics, rattles, wind whistles, and noise due to thermal movement, thermal movement transmitted to other building elements, and wind pressure. Assemblies shall be free from loosening, weakening, or fracturing of attachments by components.

6. Attachment considerations are to take into account Site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening, or fracturing connection between units and building structure or between units themselves.

7. System shall drain any water entering system to the exterior of system.

8. Concealed fastening shall be provided.

9. Uniform color and profile appearance shall be provided at components exposed to view.

E. Performance Requirements:

1. Fixed Windows:

Air Infiltration (ASTM E 283)	Maximum 0.06 cfm/sq ft surface area, at differential static pressure of 6.24 psf
Water Infiltration (ASTM E 331)	No water penetration at test pressure of 8 psf
Maximum Deflection (ASTM E 330)	L/175 of span at structural design criteria indicated, allowable stress with a safety factor of 1.65

2. Operable Windows:

Air Infiltration (ASTM E 283)	Maximum 0.030 cfm/sq ft surface area, at differential static pressure of 1.57 psf
Water Infiltration (ASTM E 331)	No water penetration at test pressure of 10.0 psf
Maximum Deflection (ASTM E 330)	When closed and locked, maximum deflection of L/175 at pressure difference of 65 psf

F. Thermal Requirements:

1. Fixed Windows:

   a. Thermal Transmittance Performance (AAMA 1503): U-Value 0.63.
   b. Condensation Resistance Factor (CRF) 63.

2. Operable Windows:

   a. Thermal transmittance performance (AAMA 503.1): U-Value 0.70.
   b. Condensation resistance factor (CRF): 49.

G. Aluminum window systems shall accommodate expansion and contraction movement due to surface temperature differentials without causing buckling, stresses on adjacent work, undue stress on structural elements, damaging loads on fasteners, reduction of performance, stress on glazing, failure of joint seals, or other visual or technical detrimental effects.

2.2 ACCEPTABLE MANUFACTUERS

A. Manufacturer and Product:

1. Subject to the requirements indicated, provide manufacturer and product listed below.

a. Fixed Windows – Kawneer Co. Inc.; Trifab Versaglaze 451T Center Glazed Storefront System (with Thermal Break).

b. Operable Windows (Project-out Windows) – Kawneer Co. Inc.; 8225 TL Series Project-out Windows.

c. Equal products by Wausau Window and Wall Systems, or Tubelite Inc.

2.3 ALUMINUM WINDOWS

A. ASTM B 221, alloy 6063-T5 for extrusions; ASTM B 209, alloy 5005-H34 for sheets; or other alloys and temper recommended by manufacturer appropriate for the finish.

B. Internal reinforcing shall be ASTM A 36 for carbon steel; or ASTM B 308 for structural aluminum.

1. Shapes and sizes to suit installation.

2. Steel shall be galvanized and apply shop-coat steel components after fabrication with alkyd type zinc chromate primer complying with FS TT-P-645.

C. Inserts and anchoring devices shall be manufacturer's standard formed or fabricated assemblies, steel or aluminum, of shapes, plates, bars, or tubes.

1. Steel shall be galvanized and apply shop-coat steel components after fabrication with alkyd type zinc chromate primer complying with FS TT-P-645.

D. Fasteners shall be aluminum, non-magnetic stainless steel or other materials warranted by manufacturer to be non-corrosive and compatible with components being fastened.

1. Exposed fasteners shall not be used.

2. For concealed locations, manufacturer's standard fasteners shall be provided.

3. Provide nuts or washers of design having means to prevent disengagement; deforming of fastener threads is unacceptable.

E. Operable windows shall conform to the requirements of ANSI Standard A 117.1.

2.4 ACCESSORIES

A. Sill Extensions: Sill extensions shall be a one-piece extruded 0.060 aluminum.

B. Sill extension finish shall be the same as window, custom color to match adjacent exterior wall, as approved by Engineer.

C. Expansion anchor devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.

D. Shims: Non-staining, non-ferrous, type as recommended by system manufacturer.

E. Protective Coatings: To separate dissimilar materials, provide cold applied asphalt mastic complying with the SSPC Paint 12, compounded for 30-mil thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.

F. Glazing Gaskets:

1. Compression type design, replaceable, molded or extruded neoprene, or ethylene propylene diene monomer (EPDM).

2. Glazing gasket shall comply with ASTM C 509 or ASTM C 864

3. Profile and hardness shall be as necessary to maintain uniform pressure for watertight seal.

4. Provide in manufacturer's standard black color.

5. Factory molded corners shall be required at exterior.

G. Internal Sealant: Types recommended by sealant manufacturer to remain permanently elastic, tacky, non-drying, non-migrating and weather tight.

H. “Anti-walk” Edge Blocking: “W” shaped EPDM blocks for use in keeping glazing material stationary under vibration or seismic loading. Edge blocking may be used for pressure plate systems.

I. Weatherstripping: Extruded EPDM elastomeric conforming to ASTM C 509 or C 864.

J. Baffles at Weepholes for Aluminum Framed Systems: Type as recommended by system manufacturer and shown in published installation instructions.

2.5 FINISH AND COLOR

A. Finish system shall be 2.0-mil, PVF2 Kynar 500, formulated by a licensed formulator to contain 70 percent PVF resin and applied by a licensed applicator.

1. Epoxy prime coat shall be applied to exposed sides to a dry film thickness of approximately 0.2-mil. One coat of PVF color coating shall be applied to exposed sides to provide a dry film thickness of not less than 0.8-mil, for a total of 1.0-mil total coating.

2. The surface condition of this finish coat shall be 100 percent free of holidays, drip marks, scratches, roll marks, or abrasions that are visible from a distance of 5-feet in good light when in installed position. Surfaces shall be free of checking, crazing, peeling, or loss of adhesion.

3. Finish shall meet or exceed AAMA 2605.

4. Color shall be selected and approved by the OWNER from manufacturer's full color range including custom colors, and may be required to exactly match other building components, as determined by the OWNER.

    a. Tentative color selection: Colors shall exactly match colors indicated below, as selected and approved by the ENGINEER.

        1) PPG Industries, Inc., as selected and approved by the ENGINEER.

    b. Color shall be uniform with no variation in shade, and aluminum windows or accessories of different color batches will not be acceptable

    c. The OWNER reserves the option of changing this tentative color selection during the submittal process.

2.6 FABRICATION

A. The CONTRACTOR shall field verify size, location, and placement of aluminum windows, shall advise the ENGINEER in writing of any necessary adjustments, and shall make the necessary adjustments prior to fabrication. The CONTRACTOR shall coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments.

1. Aluminum windows shall be assembled before shipment to the Site.

B. Accurate relation of planes and angles shall be maintained, with hairline fit of contacting members.

C. The CONTRACTOR shall make provisions in framing for minimum edge clearance, nominal edge cover, and nominal pocket width for thickness and type of glazing or infill used in accordance with recommendations of manufacturer and the Flat Glass Marketing Association (FGMA) Glazing Manual.

    1. Refer to Section 08 81 00 – Glazing.

D. Welding shall comply with AWS recommendations.

    1. Recommended electrodes and methods shall be used to avoid distortion and discoloration.
    2. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.

E. Holes or slots, deflector plates, water deflectors, and sealant shall be provided to accommodate internal weep and drainage to the exterior.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with manufacturer's written instructions.

3.2 PROJECT CONDITIONS

A. Comply with manufacturer's written instructions for environmental conditions before, during, and after installation.

B. Protect surrounding Work from damage that may result from operations under this Section.

3.3 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the Work under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

2. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units shall be rejected.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent Work.

1. Examine substrates, areas, and conditions where aluminum windows and appurtenances will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed aluminum windows.

a. Provide inserts, backing, blocking, anchoring devices, and reinforcements that must be built into other work for the installation of aluminum windows. Coordinate delivery with other work to avoid delay.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate the CONTRACTOR'S acceptance of the substrate, areas, and conditions.

3.4 PREPARATION

A. Sequence installation properly with the installation and protection of other Work, so that neither will be damaged by the installation of the other.

3.5 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with applicable references, with the requirements of the CODE, and with manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the ENGINEER.

B. The CONTRACTOR shall provide corrosion resistant fasteners, anchors, and shims required for a complete installation, and shall be secure, plumb, level, straight, and true to line, allowing for required movement, including expansion and contraction.

C. The CONTRACTOR shall provide separation of dissimilar materials to ensure no galvanic action occurs.

D. The CONTRACTOR shall block and reinforce walls as required to support the aluminum windows and appurtenances.

E. Horizontal lines shall be level, and vertical lines shall be plumb.

F. Sill extensions shall be provided at exterior aluminum window installations.

G. Tolerances:

1. Limit variations from plumb and level:

a. ⅛ inch (3.2 mm) in 20 feet (6.1 m) vertically and horizontally.
b. ¼ inch (6.4 mm) in 40 feet (12.2 m) either direction.

2. Limit offsets in theoretical end-to-end and edge-to-edge alignment:

a. Allow 1⁄16 inch (1.6 mm) where surfaces are flush or less than ½ inch (13 mm) out of flush and separated by not more than 2 inches (51 mm).

b. ⅛ inch for surfaces separated by more than 2 inches (51 mm).

3. Step in Face: $^{1}\!/_{16}$ inch (1.6 mm) maximum.

4. Jog in Alignment: $^{1}\!/_{16}$ inch (1.6 mm) maximum.

5. Location: ¼ inch (6.4 mm) maximum deviation of any member at any location.

6. Tolerances are not accumulative.

H. Sealants:

1. Internal metal-to-metal joints shall be caulked, where required to provide the required performance as components are installed.

2. Perimeter members shall be sealed per manufacturer's installation instructions or as required for unique job conditions. Set other members with internal sealant and baffles as required by manufacturer's installation instructions. Use ultraviolet resistant sealant as recommended in writing by sealant manufacturer.

3. CONTRACTOR shall coordinate installation of perimeter sealant and backing materials between assemblies and adjacent construction in accordance with requirements of Section 07 92 13 – Sealants and Caulking.

4. Seal locations necessary to create and secure continuous enclosure even though Drawings may not indicate locations to be sealed.

5. Seal joints to prevent migration of water vapor or air to interior of building.

I. Glazing:

1. Glazing gaskets and sealant shall be installed in accordance with manufacturer written instructions without exception, including surface preparations.

2. “Anti-walk” edge blocking shall be utilized on vertical edges of glazing.

3. Refer to Section 08 81 00 – Glazing for additional requirements.

3.6 CLEANING

A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of the CONTRACTOR.

2. Residue shall not be left on any surfaces.

B. Upon completion of the installation, aluminum windows and appurtenances shall be cleaned of dirt and other foreign matter to the satisfaction of the ENGINEER.

1. Cleaning shall be performed again immediately prior to acceptance of the Work, when directed by the ENGINEER.

2. Cleaning shall be performed in accordance with the manufacturer's written instructions.

C. Aluminum windows shall be protected from damage from subsequent construction operations.

D. The CONTRACTOR shall make adjustments required and retest until accepted.

E. The CONTRACTOR shall remove scratches and blemishes to the satisfaction of the ENGINEER.

F. Damaged or defective items shall be removed and replaced at the direction of the ENGINEER.

G. When aluminum window Work is completed, remove unused materials, containers, and equipment, and clean the Site of aluminum window debris.

END OF SECTION

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SECTION 08 71 00 – DOOR HARDWARE

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide door hardware and appurtenant WORK, complete, in place, and operational in accordance with the Contract Documents.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. Americans with Disabilities Act (ADA):

ADAAG Americans with Disabilities Accessibility Guidelines

C. American National Standards Institute (ANSI):

ANSI A 117.1 Accessible and Usable Buildings and Facilities

ANSI A 156.1 Butts and Hinges

ANSI A 156.3 Exit Devices

ANSI A 156.4 Door Controls – Door Closers

ANSI A 156.5 Auxiliary Locks and Associated Products

ANSI A 156.6 Architectural Door Trim

ANSI A 156.7 Template Hinge Dimensions

ANSI A 156.8 Door Controls – Overhead Stops

ANSI A 156.13 Mortise Locks and Latches

ANSI A 156.15 Closer Holder Release Devices

ANSI A 156.16 Auxiliary Hardware

ANSI A 156.18 Material and Finishes

D. Builders' Hardware Manufacturers' Association (BHMA).

E. Building Code: Refer to the Drawings to determine which Building Code applies. The applicable Building Code, defined by the Drawings, is referenced herein as "the CODE."

F. Door and Hardware Institute (DHI): Recommended Procedure for Processing Hardware Schedules and Templates" and "Architectural Hardware Scheduling and Format."

G. National Fire Protection Association (NFPA):

NFPA 80 Fire Doors and Windows

NFPA 101 Life Safety Code

H. Uniform Building Code (UBC):

UBC 7-2 Fire Tests of Door Assemblies

I. Underwriters' Laboratories (UL):

UL 10 Standard for Fire Test Door and Assemblies

UL 10C Positive Pressure Fire Tests of Door Assemblies

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Literature: Manufacturer's specifications, technical data, installation methods, and maintenance instructions.

C. Warranty: Submit a copy of the warranty.

D. Certifications:

1. Certification by the door hardware Manufacturer that the door hardware provided is suitable for, and compatible with, the required installation.

2. Certification of Manufacturer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, Manufacturer's products, and contact information of the consultant firm of record, general contractor and owner.

3. Certification of supplier's qualifications demonstrating compliance with the qualifications requirements indicated.

4. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, and contact information of the consultant firm of record, general contractor and owner.

5. Submit certification from a recognized testing agency that fire doors have passed tests to meet fire ratings indicated.

6. Certification that materials, construction requirements, and fire ratings will be met in the final installation.

7. Certification for hardware in fire rated openings indicating compliance with UL 10C and UBC 7-2.

8. When requested by the ENGINEER, furnish other certifications as may be required to show compliance with the Contract Documents.

E. Shop Drawings: Complete Shop Drawings showing location and detail of installation.

1. Furnish a complete, detailed hardware schedule. The hardware schedule shall indicate groups, type, style, function, Manufacturer's name, catalog number, location, and finish of each item to be provided, in accordance with the DHI "Architectural Hardware Scheduling Sequence and Format." The hardware schedule shall include the following additional information:

a. List each door opening, organized into "hardware sets" indicating complete designations of every item required for each door opening to function as intended.

b. Location of each hardware set cross-referenced to floor plans and schedules on the Drawings.

c. Door sizes shall be noted on the hardware schedule, and hardware shall be in strict accordance with height, width, and thickness requirements.

d. Special mounting instructions or requirements that vary from standard.

e. Handing and degree of swing of each door.

f. Keying information.

g. Fastenings and other pertinent information.

h. Explanation of all abbreviations, symbols, and codes contained in schedule.

i. The hardware schedule shall also include a complete template list showing template references and data for each item requiring preparation of doors and frames.

j. Submit separate detailed keying schedule for approval indicating clearly how the OWNER'S final instructions on keying of locks has been fulfilled.

F. Samples: When requested by the ENGINEER, submit samples of the materials proposed. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by the ENGINEER. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the CONTRACTOR from compliance with the Contract Documents.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Door hardware shall be provided by a single Manufacturer, each.

B. Manufacturer Qualifications:

1. Door hardware Manufacturer shall have a minimum of 20 years of door hardware manufacturing experience.

2. Door hardware Manufacturer shall have a minimum of 5 similar successful projects over the most recent 10 years, employing similar products, materials, applications, and performance requirements.

3. Manufacturers without these qualifications will not be accepted.

C. Supplier Qualifications:

1. Supplier shall be a recognized architectural door hardware supplier who has maintained an office and has been furnishing hardware in the project's vicinity for a period of at least 2 years.

2. Supplier shall employ at least one Architectural Hardware Consultant (AHC) who shall be responsible for the preparation and execution of the WORK of this Section and who shall be available to the OWNER, the ENGINEER, and the CONTRACTOR during business hours for consultation about the project's hardware and requirements.

3. Supplier shall be a certified direct distributor and be a full sales and service organization for the Manufacturers proposed.

4. Suppliers without these qualifications will not be accepted.

D. Installer Qualifications:

1. Installer shall have a minimum of 5 years' experience in the successful completion of at least 5 projects of similar size and scope, employing similar products, materials, applications, and performance requirements.

2. Installer shall be trained, certified, and authorized by the Manufacturer to install the Manufacturer's product.

3. Installers without these qualifications will not be accepted.

1.5 SPECIAL WARRANTY PROVISIONS

A. Furnish Manufacturer's written warranty to cover defects in materials, products, and manufacturing workmanship. The term of the warranty shall be as indicated below:

1. Mortise Locksets: 5 years.
2. Exit Devices: 5 years.
3. Door Closers: 10 years.

B. The CONTRACTOR shall furnish separate, but concurrently running, 5-year written warranty to cover labor.

C. Warranties shall be non-prorated for the entire warranty period.

D. The term of the warranties shall begin on the date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL

A. Door hardware shall be recommended by the Manufacturer for the installation indicated.

B. Door hardware shall be suitable for, and compatible with, the required installation.

C. Door hardware shall be best grade, entirely free from imperfections in manufacture and finish. Qualities, weights, and sizes specified herein are the minimum that will be accepted.

D. Hand of door shall be as indicated. If door handing changes prior to fabrication, the CONTRACTOR shall make necessary adjustments at the direction of the ENGINEER.

E. The WORK hereunder shall include fabrication and mounting templates as needed for fabricators and for control of application of hardware items.

1. In addition thereto, the CONTRACTOR shall provide trim, attachments, and fastenings indicated or required for proper and complete installation.

F. Door hardware shall be coordinated with other WORK requiring door hardware or attaching to it. Copies of schedules, templates, etc., shall be furnished in ample time to avoid fabrication and construction delays. Each item of hardware shall be identified according to the approved list and schedule. Hardware shall be made to template.

G. The CONTRACTOR shall furnish the hardware supplier with Shop Drawings from other trades with which hardware must be coordinated. After checking these Shop Drawings, the CONTRACTOR shall promptly supply necessary template information to all concerned as may be required to facilitate the progress of the job.

1. Furnish all templates and schedules required by the Manufacturers of the doors and frames to enable the Manufacturers to make proper provision in their WORK to receive the door hardware. All locks, lock strikes, and flush bolts shall be made to ANSI standard dimensions.

2. Procedures for template information shall be in accordance with the handbook, “Recommended Procedure for Processing Hardware Schedules and Templates.”

2.2 FIRE RATED OPENINGS

A. Hardware furnished in connection with doors bearing UL Labels or where necessary to meet special requirements shall be in strict accordance with the CODE and shall be subject to approval of the authority having jurisdiction.

B. Provide door hardware for fire-rated openings that comply with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed by Underwriters Laboratories Inc. (UL) for use on types and sizes of doors indicated.

1. UL labeled doors shall have UL approved hardware, except that hinges that are not UL approved shall have a melting point greater than 2,000 degrees F (1093 degrees C).

2. Certifications of compliance shall be made available to the Authority Having Jurisdiction upon request.

C. Door assemblies and components shall be compliant with positive pressure and S-label requirements. Door hardware shall be coordinated with door Manufacturers to ensure that total opening installation is compatible with UL 10C and UBC 7-2.

2.3 HINGES

A. Manufacturer or Equal: Subject to the requirements indicated, provide products from the Manufacturer listed below, or equal.

1. McKinney.
2. Pemko.

B. Description:

1. Hinges shall conform to ANSI A 156.1/BHMA A 2111 and shall be 5-knuckle design, heavy weight (0.180-inch minimum (4.6 mm)), ball bearing type, with flush tips.

2. Two hinges shall be provided for each door leaf up to and including 5-feet (1.5 m) in height and an additional hinge shall be added for each 2½-feet (.76 m) or fractions thereof of additional door height.

3. Hinges shall be 4½ inches (114.3 mm) by 4½-inches (114.3 mm), except at doors exceeding 36-inches (914 mm) in width.

a. Doors exceeding 36-inches (914 mm) in width shall have 5-inches (127 mm) by 4½-inches (114.3 mm) hinges.

4. Hinges on exterior doors shall be provided with non-removable pins (NRP).

5. Provide hinges with countersunk, Phillips flat-head screws unless otherwise indicated.

2.4 CYLINDERS AND KEYING

A. Manufacturer and Product, or Equal: Subject to the requirements indicated, provide Manufacturer and product listed below, or equal:

Sargent, Signature High Security Cylinders.

B. Description:

1. Locks and cylinders shall be master keyed to the OWNER'S requirements as directed by the ENGINEER.

2. The CONTRACTOR shall have the hardware supplier submit a keying schedule for approval prior to placing an order for the locks and keying of cylinders. The keying schedule shall be coordinated between the OWNER, the ENGINEER, the CONTRACTOR, and the hardware supplier.

C. Keying:

1. Locks and cylinders shall be construction master-keyed. Locks and cylinders to be master-keyed or grandmaster-keyed as directed by the OWNER. The factory shall key locks and cylinders. Furnish the following key amounts:

   a. 2 change keys per lock.
   b. 3 grand master keys.
   c. 6 master keys per master level.
   d. 6 construction/temporary keys.

2. Master keys and all high-security or restricted keyway blanks shall be sealed in tamper-proof packaged boxes when shipped from the factory. The boxes shall be shrink-wrapped and imprinted to ensure the integrity of the packaging.

2.5 KEY CABINET

A. Manufacturer or Equal: Subject to the requirements indicated, provide products from the Manufacturer listed below, or equal.

1. Teklee.

B. Description: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150 percent of the number of locks required for the project.

2.6 SURFACE MOUNTED OVERHEAD CLOSERS

A. Manufacturer and Product, or Equal: Subject to the requirements indicated, provide Manufacturer and product listed below, or equal:

1. Sargent 351 Series.

B. Description:

1. Closers shall be ANSI A 156.4, Grade 1 Certified.

2. Closers shall have non-ferrous covers, one-piece, aluminum alloy bodies forged steel arms, and separate valves for adjusting and backcheck, closing and latching cycles, and adjustable spring to provide up to 50 percent increase in spring power.

3. Closers shall be furnished with parallel arm mounting on doors and shall be mounted to permit 180-degree door swing wherever wall conditions permit. Furnish without hold open arms unless otherwise indicated. Closers shall not be installed on exterior or corridor side of doors; install closers on door unless otherwise approved in writing by the ENGINEER.

4. Closers shall be powder coated to match door hardware with a special rust inhibitor (SRI) pretreatment, as recommended in writing by the Manufacturer, applied prior to the powder coating.

5. Where closers or other items have lever or similar arms, attachment to doors shall be with sex bolts only.

6. Closers for out-swinging exterior doors shall be top-jamb-mounted and furnished with adapter plates.

7. The CONTRACTOR shall be responsible to provide the correct arm with the closers.

8. Closers shall be provided with sex bolts for fastening through doors, frames and transoms.

2.7 MORTISE LOCKSETS AND LATCHSETS

A. Manufacturer and Product, or Equal: Subject to the requirements indicated, provide Manufacturer and product listed below, or equal:

1. Sargent 8200 Series.

B. Description:

1. Locksets shall be ANSI A 156.13 Series 1000 Grade 1. Functions shall be manufactured in a single sized case formed from minimum 12-gauge steel. Lockset shall have a field-adjustable, beveled armored front, with a 0.125-in (3.2 mm) minimum thickness and shall be reversible without opening the lock body. The lockset shall be 2¾-inch (69.9 mm) backset with a one-piece ¾-inch (19 mm) anti-friction stainless steel latchbolt. The deadbolt shall be a full 1-inch (25.4 mm) throw made of stainless steel and have two hardened steel roller inserts. To insure proper alignment, all trim, shall be thru-bolted and fully interchangeable between rose and escutcheon designs.

2. Function of locksets shall be appropriate for doors use. Hardware supplier shall verify lock functions with the OWNER and the ENGINEER prior to ordering material.

3. Lock strikes shall be non-handed, boxed type of sufficient length and having curved lips to protect the trim and jambs and be so shaped as to avoid the possibility of tearing clothing. Strikes shall be provided with metal strike boxes.

4. Locks shall be provided with the same cylinder and keyway for master keying. They shall be the product of the same Manufacturer as the locksets unless otherwise indicated. The correct cylinders with necessary modifications and components such as cams, collars, rings, retainers, plates, fasteners, etc., shall be provided for other specialty hardware such as exit devices, store front locksets, and sliding door locks where the hardware manufacture specified is different than cylinder Manufacturer.

5. Exit doors shall be openable at all times from the inside without the use of key or any special knowledge or effort.

2.8 STRIKES

A. Manufacturer: To be provided by exit device and lockset and latchset device Manufacturer.

B. Description:

1. Strikes shall be compatible with the installation required.

2. All strikes shall be non-handed with a curved lip.

2.9 EXIT DEVICES

A. Manufacturer and Product, or Equal: Subject to the requirements indicated, provide Manufacturer and product listed below, or equal:

1. Sargent, 80 Series.

B. Description:

1. Exit devices shall be certified to meet ANSI A 156.3 Grade 1.

2. Exit devices shall be listed by Underwriters Laboratories and shall bear the UL label for life safety in full compliance with NFPA 80 and NFPA 101.

3. Mounting rails shall be formed from a solid single piece of stainless steel, brass, or bronze no less than 0.072-inch (1.83 mm) thick. Push rails shall be constructed of 0.062-inch (1.57 mm) thick material. Painted or anodized aluminum shall not be considered heavy duty and are not acceptable. Hex key dogging shall be standard for all life safety panic hardware. Lever trim shall be available in finishes and designs to match that of the specified locksets.

2.10 LOCK GUARDS

A. Manufacturer, or Equal: Subject to the requirements indicated, provide products from the Manufacturer listed below, or equal.

1. McKinney.

B. Description: Provide high security, corrosion resistant, surface mounted lock guards with concealed fasteners compatible with the installation, at each exterior door.

2.11 DOOR TRIM AND PROTECTIVE PLATES

A. Manufacturer, or Equal: Subject to the requirements indicated, provide products from the Manufacturer listed below, or equal.

1. McKinney.
2. Pemko.

B. Description:

1. Kickplates shall be 0.050-gauge, 2-inches (50.8 mm) less width of door, beveled on 3 sides, and 10-inches (254 mm) high, except where necessary to clear a louver in which case they shall be 8-inches (213 mm) high.

2. Push plates, pull plates, door pulls, and miscellaneous door trim shall be as indicated.

2.12 OVERHEAD STOPS WITH HOLD OPEN FUNCTION

A. Manufacturer and Product, or Equal: Subject to the requirements indicated, provide Manufacturer and product listed below, or equal:

1. Rixson.

B. Description:

1. Overhead type door holders shall be of correct size for door, 90 degree openable and allowing for checkmating. Interior doors shall be provided with overhead stops if wall type stops cannot be used.

2. Track, slide, arm, and jamb bracket shall be constructed of extruded bronze and shock absorber spring shall be of heavy tempered steel.

3. Overhead stops shall be of non-handed design.

2.13 WEATHERSTRIPPING, GASKETING AND SEALS

A. Manufacturer, or Equal: Subject to the requirements indicated, provide products from the Manufacturer listed below, or equal.

1. McKinney.
2. Pemko.

B. Description:

1. Provide continuous weatherseal on exterior doors.

2. Provide continuous light or sound seals on interior doors where indicated.

3. Provide UL rated fire and smoke seals on all fire rated doors. Provide intumescent seals as required to meet UL 10C and UBC 7-2. Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by Manufacturer.

2.14 THRESHOLDS

A. Manufacturer, or Equal: Subject to the requirements indicated, provide products from the Manufacturer listed below, or equal.

1. McKinney.
2. Pemko.

B. Description:

1. Provide threshold at each exterior door, and at other locations where indicated. Provided in size and configuration indicated, fabricated to accommodate door hardware and to fit door frames.

2. Thresholds shall be aluminum unless otherwise noted.

3. Threshold units shall comply with ADAAG and ANSI A 117.1.

4. At Fire Rated doors, provide UL rated thresholds.

5. Where adjacent floor material differs, provide threshold as appropriate.

6. Provide marble threshold at toilet rooms.

2.15 SILENCERS

A. Manufacturer and Product, or Equal: Subject to the requirements indicated, provide Manufacturer and product listed below, or equal:

1. McKinney.
2. Pemko.

B. Description: Interior door frames shall be provided with rubber silencers, 3 for each single door and 2 for each pair of doors.

2.16 FASTENERS

A. Provide necessary screws, bolts, and other fasteners of suitable size and type to secure the hardware into position. The fasteners shall match the hardware in material and finish.

B. The hardware provided, such as expansion bolts, sex bolts, toggle bolts and other approved anchorages shall be coordinated with the job and to each setting condition.

C. Phillips head screws shall be used at exposed conditions. Machine screws shall be used at metal doors and frames.

D. Required screws shall be supplied as necessary for securing door hardware in the appropriate manner. Thru-bolts shall be supplied for exit devices and door closers where required by the CODE and where the appropriate blocking or reinforcing is not present in the door to preclude their use.

2.17 FINISHES

A. Door hardware shall be 630/US 32D (stainless steel satin finish) unless otherwise indicated.

B. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI A 156.18 including coordination with traditional U.S. finishes shown by certain Manufacturers for their products.

C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with Manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

1. Locks, exit devices, door closers, overhead door holders, hinges, kickplates, pulls and push plates, thresholds, and other similar items shall be individually packed in separate, suitable, original, containers as furnished by the hardware Manufacturers. Each container shall be clearly marked with item numbers, article numbers, and names corresponding to those listed in the hardware schedule.

a. Small miscellaneous items that would not require specific location identifications, such as wall mounted stops and silencers may be quantity packed if properly labeled with item numbers and other identification.

2. The CONTRACTOR shall check the hardware upon delivery with the aid of a representative of the hardware supplier's firm.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after installation.

1. The CONTRACTOR shall make certain that the building is secured and free from weather elements prior to installing interior door hardware.

B. Protect surrounding WORK from damage that may result from operations under this Section.

3.3 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

2. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units shall be rejected.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where door hardware will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed door hardware.

a. Provide inserts, backing, blocking, anchoring devices, and reinforcements that must be built into other WORK for the installation of door hardware. Coordinate delivery with other WORK to avoid delay.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate CONTRACTOR'S acceptance of the substrate, areas, and conditions.

3.4 PREPARATION

A. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

3.5 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with applicable references, with the requirements of the CODE, ADAAG, ANSI A 117.1 and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the ENGINEER.

1. Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with the governing regulations.

a. The CONTRACTOR shall comply with DHI recommended locations for hardware as applicable for specified doors.

B. The CONTRACTOR shall provide corrosion resistant fasteners, anchors, and shims required for a complete installation, and shall be secure, plumb, and true to line, allowing for required movement, including expansion and contraction.

C. The CONTRACTOR shall provide separation of dissimilar materials to ensure no galvanic action occurs.

D. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing WORK specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

3.6 CLEANING, FINISHING, AND PROTECTION

A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of the CONTRACTOR.

2. Residue shall not be left on any surfaces.

B. Upon completion of the installation, door hardware and appurtenances shall be cleaned of dirt and other foreign matter to the satisfaction of the ENGINEER.

1. Cleaning shall be performed again immediately prior to acceptance of the WORK, when directed by the ENGINEER.

2. Cleaning shall be performed in accordance with the Manufacturer's written instructions.

C. Adjusting and cleaning shall consist of ensuring smooth operation, lubricating and testing the door hardware.

1. Door hardware shall operate smoothly, quietly, and without squeaking and binding.

a. The CONTRACTOR shall adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

b. Latches and bolts shall be installed to automatically engage in keepers, whether activated by closers or by manual push. In no case should additional manual pressure be required to engage latch or bolt in keepers.

c. Closers and hinges shall be carefully adjusted to operate the doors noiselessly and evenly, and hinges shall be installed so as not to bind. Closers, closer arms, and hold-open arms shall be attached with sex bolts.

d. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Door hardware shall be protected from damage from subsequent construction operations.

E. The CONTRACTOR shall make adjustments required and retest until accepted.

F. The CONTRACTOR shall remove scratches and blemishes to the satisfaction of the ENGINEER.

G. Damaged or defective items shall be removed and replaced at the direction of the ENGINEER.

H. When door hardware WORK is completed, remove unused materials, containers, and equipment, and clean the Site of door hardware debris.

I. The hardware Supplier shall do a final inspection prior to Substantial Completion to ensure that all hardware has been correctly installed and is in proper working order, and shall provide a written report of this inspection to the ENGINEER the file.

3.7 HARDWARE SCHEDULE

A. The following schedule is furnished for whatever assistance it may afford the CONTRACTOR. The CONTRACTOR shall not consider it as entirely inclusive. Should any particular door or item be omitted in any scheduled hardware group, the CONTRACTOR shall provide door or item with hardware same as required for similar purposes as accepted by the ENGINEER, and at no additional cost to the OWNER. Quantities listed are for each pair of doors, or for each single door.

B. Hardware Schedule:

1. ISC –Interior Single Doors (Office):

Quantity	Device	Description
Per Spec.	Hinges	
1	Lockset F05 (classroom)	
1	Closer	
Per Spec	Continuous Sounds Seals	
2	Kickplate	
1	Threshold (where indicated)	Pemko 151 A Mill Aluminum

2. TR – Interior Single Doors (Men's and Women's Toilet Rooms):

Quantity	Device	Description
Per Spec.	Hinges	
1	Lockset (F22)	
1	Closer	
Per Spec.	Continuous Sounds Seals	
2	Kickplate	
1	Threshold	Marble, See Details

3. IS – Interior Single Doors (Closet)

Quantity	Device	Description
Per Spec.	Hinges	
1	Latchset (F01) (passage)	
Per Spec.	Continuous Sounds Seals	
1	Threshold (where indicated)	Mill Aluminum, See Details

4. ISE –Interior Single Exit Doors:

Quantity	Device	Description
Per Spec.	Hinges	
1	Exit Device (ANSI 08)	8313 ET
1	Electric Strike/ Electric Hinge	As required, see Electrical Drawings
1	Power Supply	As required, see Electrical Drawings
1	Closer	
1	Kickplate	
1	Threshold	Pemko 2005AV Mill Aluminum

Quantity	Device	Description
1	Weatherstrip/Gasketing	Pemko S88D at Head and Jambs
1	Door Bottom	Pemko 321DN Annodized Aluminum
1	Card Reader (per door schedule drawing)	See Electrical Drawings

5. ES – Single Exterior Doors:

Quantity	Device	Description
Per Spec.	Hinges	
1	Exit Device (ANSI 08)	8313 ET
1	Electric Strike/ Electric Hinge	As required, see Electrical Drawings
1	Power Supply	As required, see Electrical Drawings
1	Closer	
1	Kickplate	
1	Threshold	Pemko 2005AV Mill Aluminum
1	Weatherstrip/Gasketing	Pemko S88D at Head and Jambs
1	Door Top Drip	Pemko 346 at Door Head
1	Door Bottom	Pemko 321DN Annodized Aluminum
1	Card Reader	See Electrical Drawings

END OF SECTION

SECTION 08 81 00 – GLAZING

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide glazing and appurtenant WORK, complete and in place, in accordance with the Contract Documents.

B. The CONTRACTOR shall coordinate color samples with other Sections through the submittal process.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. American Society for Testing and Materials (ASTM):

ASTM C 1036 Flat Glass

ASTM C 1048 Heat Treated Flat Glass, Kind HS, FT Coated and Uncoated Glass

ASTM E 2190 Standard Specification for Insulating Glass Unit Performance and Evaluation

C. Building Code: Refer to the Drawings to determine which Building Code applies. The applicable Building Code, defined by the Drawings, is referenced herein as “the CODE”.

D. Glazing Association of North America (GANA).

E. Insulating Glass Certification Council (IGCC).

F. National Fire Protection Association (NFPA).

G. Underwriters Laboratories Inc. (UL).

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Literature: Manufacturer’s specifications, technical data, installation methods, maintenance instructions, and the following:

1. Step-by-step glass, glazing, setting, and sealing procedures.

2. Manufacturer’s full-range color charts, indicating custom color for color selection by ENGINEER.

C. Warranty: Submit a copy of the warranty.

D. Certifications:

1. Certification of compliance with the requirements of paragraph 2.1.A.

2. Certified copies of recent test reports of systems similar to the design for this project substantiating performance of system in lieu of re-testing. Other supportive data shall be included as necessary.

3. For insulating glass units, furnish CBA certification from the IGCC.

4. Certification that the glazing materials have been tested in accordance with the ASTM test methods indicated.

5. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, and contact information of the consultant firm of record, general contractor and owner.

E. Shop Drawings: Complete Shop Drawings showing location and detail of installation.

1. Shop Drawings shall indicate thickness, dimension, U-values, R-values, and related data.

2. Include detail glazing methods, framing, and tolerances to accommodate thermal movement.

F. Samples: The CONTRACTOR shall submit 2 samples of each of the following. Unless otherwise indicated, samples shall be full size and shall show gauges, configuration, construction, finish and color proposed for the various components. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by ENGINEER. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the CONTRACTOR from compliance with the Contract Documents.

1. Twelve-inch (305 mm) by 12-inch (305 mm) samples of each glass type.
2. Twelve-inch (305 mm) by 12-inch (305 mm) samples of each laminated panel type.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility:

1. Glass shall be provided by a single Manufacturer.
2. Accessories shall be provided by a single Manufacturer, each.

B. Manufacturer's Qualifications:

1. Glass Manufacturer shall have a minimum of 5 similar successful projects over the most recent 10 years, employing similar products, materials, applications, and performance requirements.

C. Installer Qualifications:

1. Installer shall have a minimum of 5 years experience in the successful completion of at least 5 projects of similar size and scope, employing similar products, materials, applications, and performance requirements.

D. Insulating glass units shall be certified for compliance with seal classification "CBA" by the Insulating Glass Certification Council (IGCC) and tested in accordance with the ASTM test methods indicated.

1.5 SPECIAL WARRANTY PROVISIONS

A. Glass: Furnish Manufacturer's 10-year written warranty to cover defects in materials, products, and manufacturing workmanship.

B. The CONTRACTOR shall furnish separate, but concurrently running, 5-year written warranty to cover the installation and associated labor.

C. Warranties shall be non-prorated for the entire warranty period.

D. The term of the warranties shall begin on the date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Structural Requirements:

1. Glazing products, including related assemblies, components, and attachment details shall comply with the CODE and shall be designed and installed for resistance to the structural design criteria indicated in the Contract Documents in accordance with the CODE. Where a conflict occurs between the requirements of this Section and the CODE, the more stringent shall apply.

2. The CONTRACTOR shall provide additional non-standard bracing, reinforcements, anchors, and heavier gauge materials in order to conform to the structural design criteria indicated and to other performance requirements indicated.

B. Glazing shall be recommended by the Manufacturer for the installation indicated.

C. Glazing and accessories shall be suitable for, and compatible with, the required installation.

2.2 ACCEPTABLE MANUFACTURERS:

A. Subject to the requirements indicated, provide Manufacturer and product listed below:

1. Viracon, VE4-55
2. PPG Architectural Glass
3. AGC Glass Company

2.3 ARCHITECTURAL GLASS

A. Each piece of glazing shall bear the Manufacturer's label showing the strength, grade, thickness, type and quality of the material. Labels shall remain in place until the glass has been set and inspected by the ENGINEER except that safety and insulating glass shall have permanently etched labels.

B. When material is not cut to size by the Manufacturer and is furnished from local stock, the glass and glazing CONTRACTOR shall submit an affidavit stating the strength, grade, thickness, type, quality, and Manufacturer of the material furnished.

C. Float glass and annealed glass shall conform to ASTM C 1036, Type 1, Class 1 (clear) or Class 2 (tinted, heat-absorbing, and light-reducing), and Quality q3.

D. Heat treated glass shall conform to ASTM C 1048, Type 1, Class 1 (clear) or Class 2 (tinted, heat-absorbing, and light-reducing), and Quality q3, Kind HS/FT.

1. Heat-treated flat glass shall be by horizontal (roller hearth) process with inherent rollerwave distortion parallel to the bottom edge of the glass as installed.

2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements.

3. For uncoated glass, comply with requirements for Condition A.

4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).

5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is required, including, but not limited to glass in doors, and glass in lites adjacent to doors.

6. In addition to conforming to ASTM C 1048, heat treated glass shall conform to flatness tolerances indicated below:

    a. Bow and warp are defined as deviation of a glass surface from a true plane, with glass freestanding or installed in a frame and positioned in a vertical plane. Localized bow refers to any straight-line segment on a glass surface with length of 12-inches (305 mm). Overall bow refers to any straight-line segment on glass surface that extends between opposite edges and is perpendicular to at least one edge. Length of line segment is gauge length. Localized bow shall not exceed 0.0625-inch (1.6 mm). Overall bow shall not exceed: 0.041-inch per foot (1.04 mm per meter) for gauge length zero to 36- inches (914 mm); 0.031-inch per foot (.79 mm per meter) for gage length 36-inches (914 mm) to 60-inches (1524 mm); one half of the values listed in ASTM C1048-97b, Table 2 for gauge lengths exceeding 60-inches (1524 mm). Where heat-treating results in parallel ripple or waves, maximum peak-to-valley deviation shall not exceed 0.003. Requirements for localized bow and overall bow shall also be satisfied. Direction of ripples shall be consistent throughout the installation.

7. Insulating glass units shall be Insulating Glass Certification Council certified and shall meet ASTM E 2190.

    a. Insulating glass units shall be permanently and hermetically sealed together at edges with continuous spacers, and dual sealant to maintain a factory dehydrated air space.

        1) Provide dual perimeter seal, inner (primary) seal of polyisobutylene butyl, and outer (secondary) seal of structural silicone.

b. Provide aluminum spacer between lights with folded and permanently joined corners as approved to provide continuity around perimeter of each unit. Primary seal shall completely cover sides and corners of spacers between spacers and glass, both sides.

c. Lites shall be separated by an aluminum spacer with 3 bent corners and one keyed-soldered corner, or 4 bent corners and straight butyl injected zinc plated steel straight key joint, to provide a hermetically sealed and dehydrated air space.

d. Provide approved molecular sieve, silica gel, or blend of both for desiccant, sealed into spacers.

2.4 INSULATED GLASS

A. Tinted, thermal insulating units with low emissivity (Low-E) coating.

B. Insulating glass units shall be one-inch thick, comprised of 2 lites of HS float glass, except provide FT glass where required by the CODE, including but not limited to glass installed in, or adjacent to, doors.

C. Lites shall be 1/4-inch (6.4 mm) thickness each, with 1/2-inch (13 mm) air space.

D. Tentative color selection:

1. Outer lite: Bronze.

2. Inner lite: Clear.

3. The ENGINEER reserves the option of changing this tentative color selection during the submittal process.

E. Low Emissivity (Low-E) Coating shall be applied to the number 2 surface of thermal insulating glass units.

F. Light Transmittance: 27 percent.

G. Shading Coefficient: 0.29.

H. Summer U-value: 0.29 btu/hr-ft degrees F (C).

2.5 INTERIOR GLASS (NON-FIRE RATED OPENINGS):

A. Description:

1. Acoustical insulating units, thickness as indicated, comprised of 2 clear lites, FT glass.

2. 1 1/16- inch (27 mm) total thickness, comprised of one lite 1/4-inch (6.35 mm) thick, one lite 5/16-inch (7.9 mm) thick, with 1/2-inch (12.7 mm) air space.

a. Sound Transmission Class (STC): 40

2.6 INTERIOR GLASS (FIRE RATED OPENINGS):

A. Description:

1. 1/4-inch (6.35 mm) thick, clear-polished diamond welded wired glass, UL Listed.

2. Glass shall be compatible with the requirements indicated in Section 08 11 13 – Steel Doors and Frames.

2.7 ACCESSORIES

A. Glazing compound for non-fire rated glazing shall be **Dow, 999-A Glazing Silicone**, or equal.

1. Glazing compound shall be acetoxy cure silicone for adhesion to glass and metals. One-part sealant that cures in the presence of atmospheric moisture to produce a durable and flexible glazing and curtainwall seal.

B. Glazing compound for fire rated glazing shall be **Dap 33**, or equal.

1. Glazing compound shall meet the CODE, and NFPA requirements for a hard-setting glazing compound with 90 percent inert and non-flammable components.

C. Glazing Tape shall be **Tremco, No. 440,** or equal.

1. Glazing tape shall be compatible with the glazing compound.

D. Setting blocks shall be 85 +/-, 5 durometer and spacer blocks, 50 durometer, shall be closed cell neoprene.

E. Additional material to complete glazing installation shall be as recommended in writing by the Manufacturer.

F. Seals against moisture intrusion as recommended by the Manufacturer. Provide with polyurethane and silicone-based sealants with a 20-year life.

2.8 FABRICATION

A. The CONTRACTOR shall field verify size, location, and placement of glazing, shall advise ENGINEER in writing of any necessary adjustments, and shall make the necessary adjustments prior to fabrication. The CONTRACTOR shall coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments.

1. Glass shall be assembled before shipment to the Site.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after installation.

B. Protect surrounding WORK from damage that may result from operations under this Section.

3.3 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

2. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units shall be rejected.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where glazing and appurtenances will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed glazing

a. Provide inserts, backing, blocking, anchoring devices, and reinforcements that must be built into other WORK for the installation of glazing. Coordinate delivery with other WORK to avoid delay.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate the CONTRACTOR's acceptance of the substrate, areas, and conditions.

3.4 PREPARATION

A. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

3.5 INSTALLATION – GENERAL

A. Installation shall comply with the requirements of the Contract Documents, with applicable references, with the requirements of the CODE, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as determined by the ENGINEER.

B. The CONTRACTOR shall provide for a complete installation. Glazing shall be secure, plumb, level, straight, and true to line, allowing for required movement, including expansion and contraction.

C. Glazing shall be performed in accordance with the GANA standards.

D. Frame elements shall have been painted where required and shall be thoroughly cleaned before glazing commences.

E. Separate dissimilar metals using gasketed fasteners and blocking to eliminate the possibility of electrolytic reaction.

3.6 INSTALLATION OF EXTERIOR GLAZING – GASKET SYSTEM

A. Glaze per Shop Drawings using gaskets and appurtenances furnished with the system. Provide setting blocks as required.

3.7 INSTALLATION OF EXTERIOR GLAZING – NON-GASKET SYSTEM

A. Set tape 1/8-inch (3.2 mm) down from top of fixed bead.

B. Run a bead of approved gun-grade sealant from base of tape to bottom of glazing pocket leaving weep holes, where provided, free of sealant.

C. Place setting blocks, insert glass and press against tape and sealant until continuous perimeter contact is made.

D. Run a heel bead of approved sealant along exposed edge of glass.

E. Apply glazing bead.

F. Install spacer blocks between glazing bead and glass.

G. Run a continuous finish bead of sealant to fill voids above spacers on interior side and to fill void above tape on exterior side.

3.8 INSTALLATION OF INTERIOR GLAZING – NON-FIRE RATED OPENINGS

A. Install continuous glazing strip against rabbet.

B. Set glass in place on setting blocks and install another continuous glazing strip around perimeter of glass.

C. Install glazing beads, setting against glazing strips firmly in order to place a small amount of pressure against the strips.

3.9 INSTALLATION OF INTERIOR GLAZING – FIRE RATED OPENINGS

A. Bed glazing rabbet in hard-setting compound.

B. Set glass in place on setting blocks.

C. Face glass in the same compound and set beads.

D. Tool compound flush and full between glass and metal surrounds, adding compound as required.

3.10 CLEANING

A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of CONTRACTOR.

2. Residue shall not be left on any surfaces.

B. Upon completion of the installation, glazing and appurtenances shall be cleaned of dirt and other foreign matter to the satisfaction of the ENGINEER.

1. Cleaning shall be performed again immediately prior to acceptance of the WORK, when directed by the ENGINEER.

2. Clean glazing compound from frames around glazing installed under this Section upon completion of the WORK.

3. Cleaning shall be performed in accordance with the Manufacturer's written instructions.

4. Weep holes and drainage channels must be unobstructed and free from dirt and sealant.

C. Glazing shall be protected from damage from subsequent construction operations.

D. The CONTRACTOR shall make adjustments required and retest until accepted.

E. The CONTRACTOR shall remove scratches and blemishes to the satisfaction of the ENGINEER.

F. Damaged or defective items shall be removed and replaced at the direction of the ENGINEER.

G. When glazing WORK is completed, remove unused materials, containers, and equipment, and clean the Site of glazing debris.

END OF SECTION

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SECTION 08 91 00 – LOUVERS

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide louvers and appurtenant WORK, complete, in place, and operational in accordance with the Contract Documents.

B. The CONTRACTOR shall furnish professional design and engineering services as required for louvers.

1. Professional design and engineering services may be provided by the Manufacturer or by an independent licensed civil engineer retained by the CONTRACTOR, either of which shall comply with the requirements indicated.

C. The CONTRACTOR shall coordinate color samples with other Sections through the submittal process.

D. The CONTRACTOR shall coordinate the requirements herein with the building heating, ventilating, and cooling system; see Division 15 Sections of these Specifications.

E. The CONTRACTOR shall coordinate wiring requirements and current characteristics of motor operators with the building electrical system; see Division 16 Sections of these Specifications.

F. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. Air Movement and Control Association (AMCA):

Standard 500 Test Methods for Louvers, Dampers and Shutters

Standard 511 Certified Ratings Program for Air Control Devices

C. American Architectural Manufacturer's Association (AAMA):

AAMA 2605 Voluntary Specification, Performance Requirements, and Testing Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

D. American Society for Testing and Materials (ASTM):

ASTM B 211 Aluminum and Aluminum-Alloy Bar, Rod, and Wire

ASTM B 3209 Aluminum and Aluminum-Alloy Sheet and Plate

ASTM D 822 Standard Practice for Filtered Open Flame Carbon Arc Exposures of Paint and Related Coatings

ASTM D 2244 Standard Practice for Calculation of Tolerances and color Differences from Instrumentally Measured Color Coordinates

ASTM D 4214 Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films

E. Building Code: Refer to the Drawings to determine which building code applies. The applicable building code, defined by the Drawings, is referenced herein as "the CODE".

F. Sheet Metal and Air Conditioning CONTRACTOR's National Association (SMACNA): Architectural Sheet Metal Manual (ASMM).

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Literature: Manufacturer's specifications, technical data, installation methods, and maintenance instructions, and the following:

1. Performance data in accordance with AMCA Standards 500 and 511.

2. AMCA licensed data demonstrating that each louver meets the criteria herein.

3. Manufacturer's full-range color charts, indicating custom color availability at no additional cost to the OWNER, for color selection by the OWNER.

C. Warranty: Submit a copy of the warranty.

D. Certifications:

1. Certification by the louver Manufacturer, that the louvers provided are suitable for, and compatible with, the required installation.

2. Certification of compliance with the requirements of paragraph 2.1.A.

3. Certification of Manufacturer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, Manufacturer's products, and contact information of the consultant firm of record, general contractor and owner.

4. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, and contact information of the consultant firm of record, general contractor and owner.

5. When requested by the ENGINEER, furnish other certifications as may be required to show compliance with the Contract Documents.

E. Shop Drawings and Calculations: Complete Shop Drawings showing location and detail of installation, and design calculations.

1. Shop Drawings and Calculations shall be prepared, approved, and stamped by a professional civil engineer licensed per local engineering licensing laws.

2. Shop Drawings shall be drawn to sufficient scale and shall include dimensions, show elevations and details of construction of each louver type, schedule of louvers, location and installation requirements for hardware, thickness of materials, joints, provisions for expansion and contraction, connections, accessories, and trim. Shop Drawings shall show installation conditions at openings with various wall thickness and materials.

    a. Shop Drawings shall include material descriptions, finish, color, details of construction, installation, and accessories of each louver type.

F. Samples: The CONTRACTOR shall submit 2 samples of each of the following. Unless otherwise indicated, samples shall be full size and shall show gauges, configuration, construction, finish and color proposed for the various components. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by the ENGINEER. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the CONTRACTOR from compliance with the Contract Documents.

1. 3-inches (76 mm) by 4-inches (102 mm) color samples showing substrate, finish, and color.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Louvers shall be provided by a single Manufacturer, unless otherwise indicated.

B. Manufacturer Qualifications:

1. Louver Manufacturer shall have a minimum of 20 years of louver manufacturing experience.

2. Louver Manufacturer shall have a minimum of 5 similar successful projects over the most recent 10 years, employing similar products, materials, applications, and performance requirements.

3. Manufacturers without these qualifications will not be accepted.

C. Installer Qualifications:

1. Installer shall have a minimum of 5 years' experience in the successful completion of at least 5 projects of similar size and scope, employing similar products, materials, applications, and performance requirements.

2. Installers without these qualifications will not be accepted.

D. A professional civil engineer licensed per local engineering licensing laws shall design the louvers and connections to the structure.

E. Fabrication practices, construction details, and installation procedures shall conform to the practices of SMACNA as recommended in the ASMM, as applicable and as required.

F. Louvers shall bear AMCA Certified Ratings Seals for air performance and water penetration ratings

1.5 SPECIAL WARRANTY PROVISIONS

A. Furnish Manufacturer's extended 20-year written warranty for the finish. Warranty shall include provisions for failures of the finish including, but not limited to, chalking, crazing, peeling, and fading.

1. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D 4214

2. Finish color shall not change color or fade in excess of 5 NBS units as determined by ASTM D 2244 and ASTM D 822.

B. The CONTRACTOR shall furnish separate, but concurrently running, 5-year written warranty to cover labor.

C. Warranties shall be non-prorated for the entire warranty period.

D. The term of the warranties shall begin on the date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL

A. Structural Requirements:

1. Louvers, including related assemblies, components, and attachment details shall comply with the CODE and shall be designed and installed for resistance to the structural design criteria indicated in the Contract Documents in accordance with the CODE. Where a conflict occurs between the requirements of this Section and the CODE, the more stringent shall apply.

a. Refer to Section 01 33 17 – Structural Design, Support and Anchorage for additional design criteria.

2. The CONTRACTOR shall provide additional non-standard bracing, reinforcements, anchors, and heavier gauge materials in order to conform to the structural design criteria indicated and to other performance requirements indicated.

B. Louvers shall be recommended by the Manufacturer for the installation indicated.

C. Louvers shall be suitable for, and compatible with, the required installation.

D. Design Requirements:

1. Louver system Manufacturer shall furnish the systems herein, including necessary custom modifications to meet the indicated requirements and to maintain the visual design requirements as approved by the ENGINEER.

2. Stationary components of louvers shall be of all-welded design.

3. Aluminum Sheet: ASTM B 3209, Alloy 3003 and 5005 with temper as required for forming or as otherwise recommended by the metal producer to provide the required finish.

4. Aluminum Extrusions: ASTM B 211, Alloy 6063-T5, 6063-T6, or 6061-T6, unless otherwise indicated.

5. Supports, anchorage, and accessories shall be provided as required for complete assembly.

6. Perimeter conditions shall allow for installation tolerances, expansion and contraction of adjacent materials, and sealant Manufacturer's recommended joint design.

7. The CONTRACTOR shall not assume sealant and interior finishes contribute to framing member strength, stiffness, or lateral stability.

8. Assemblies shall be free from vibration harmonics, rattles, wind whistles, and noise due to thermal movement, thermal movement transmitted to other building elements, and wind pressure. Assemblies shall be free from loosening, weakening, or fracturing of attachments by components.

9. Attachment considerations are to take into account Site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening, or fracturing connection between units and building structure or between units themselves.

10. System shall drain any water entering system to the exterior of system.

11. Concealed fastening shall be provided.

12. Uniform color and profile appearance shall be provided at components exposed to view.

E. Expansion and Contraction Requirements: Louver systems shall accommodate expansion and contraction movement due to surface temperature differentials without causing buckling, stresses on adjacent WORK, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other visual or technical detrimental effects.

2.2 COMBINATION DRAINABLE LOUVERS

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal.

a. Combination wall louvers shall be Ruskin Model ELC 6375DAX.

B. Description:

1. Combination drainable louvers shall be adjustable type with drain gutter in each blade and downspouts/drainage channels in jambs and mullions. Stationary blades and adjustable blades shall be contained within a single 6-inch (152 mm) louver frame. Adjustable Section shall include low leakage blade and jamb seals. Components (heads, jambs, blades, and mullions) shall be factory assembled by the louver Manufacturer. Waterstop at sill shall be factory caulked water tight.

2. Heads, sills, jambs, mullions, and sills shall be one-piece structural aluminum members with integral caulking slot and retaining beads. Material thickness shall be 0.125-inch (3.2 mm). Mullions shall be sliding interlock with internal drains. Blades shall be one-piece aluminum extrusions with gutters designed to catch and direct water to jamb and mullion

drains. Compression gaskets shall be provided between bottom of mullion or jamb and top of sill to insure leak tight connections.

a. Continuous, 0.125-inch (3.2 mm) thick perimeter angles of same material as louvers shall be provided for attachment on inside to adjacent construction. At louvers over 6-feet (1.8 m) wide, center vertical aluminum angle support and approved aluminum blade braces shall be provided, each blade. Secure top and bottom and to each brace and blade.

3. Frame: 6-inches (152 mm) deep, 6063-T5 extruded aluminum, with .125-inch (3.2 mm) nominal wall thickness. Downspouts/drainage channels and caulking surfaces shall be provided.

4. Blades: Front stationary drainage blades, 6063-T5 extruded aluminum with .081-inch (2.06 mm) nominal wall thickness, positioned at 37½ degree angle and spaced approximately six and one-eighth inches (156 mm) on center. Rear adjustable airfoil blades, 6063-T5 extruded aluminum, 0.140-inches (3.6 mm) nominal wall thickness.

5. Motor Operator: Electric type furnished with louver, 120 volts max.

C. Performance Requirements:

1. AMCA Performance:

a. A 4-foot by 4-foot unit (1.2-meter by 1.2-meter) shall be licensed to bear the AMCA seal, and shall conform to the following:

Free Area	Minimum 7.48 sq. ft. (2.28 sq m)
Percent Free Area	Minimum 47 percent
Velocity at the Point of Beginning Water Penetration of 0.01 oz/sq. ft. (.30 ml/sq. meter)	1169 FPM (.36 KPM)
Pressure Drop at the Point of Beginning Water Penetration	0.15 inch water (3.81 mm)
Air volume	7,000 cfm

2.3 DRAINABLE STATIONARY LOUVERS

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal.

a. Combination wall louvers shall be Ruskin Model ELF 6375DXH.

B. Description

1. Drainable stationary louvers shall have drain gutter in each blade and downspouts/drainage channels in jambs and mullions. Stationary blades shall be contained within a single 6-inch (152 mm) louver frame. Components (heads, jambs, blades, and mullions) shall be factory assembled by the louver Manufacturer. Waterstop at sill shall be factory caulked water tight.

2. Heads, sills, jambs, mullions, and sills shall be one-piece structural aluminum members with integral caulking slot and retaining beads. Material thickness shall be 0.125-inch (3.2 mm). Mullions shall be sliding interlock with internal drains. Blades shall be one-piece aluminum extrusions with gutters designed to catch and direct water to jamb and mullion drains. Compression gaskets shall be provided between bottom of mullion or jamb and top of sill to insure leak tight connections.

    a. Continuous, 0.125-inch (3.2 mm) thick perimeter angles of same material as louvers shall be provided for attachment on inside to adjacent construction. At louvers over 6-feet (1.8 m) wide, center vertical aluminum angle support and approved aluminum blade braces shall be provided, each blade. Secure top and bottom and to each brace and blade.

3. Frame: 6-inches (152 mm) deep, 6063-T5 extruded aluminum, with .125-inch (3.2 mm) nominal wall thickness. Downspouts/drainage channels and caulking surfaces shall be provided.

4. Blades: Stationary drainage blades, 6063-T5 extruded aluminum with .081-inch (2.06 mm) nominal wall thickness, positioned at 37½ degree angle and spaced approximately six and one-eighth inches (156 mm) on center.

C. Performance

1. AMCA Performance:

    a. A 4-foot by 4-foot unit (1.2-meter by 1.2-meter) shall be licensed to bear the AMCA seal, and shall conform to the following:

Free Area	Minimum 9.08 sq. ft. (.84 sq m)
Percent Free Area	Minimum 57 percent
Velocity at the Point of Beginning Water Penetration of 0.01 oz/sq. ft. (.30 ml/sq. meter)	1023 FPM (312 MPM)

2.4 ACOUSTICAL LOUVERS

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal.

    a. Louvers shall be Ruskin Model ACL 1245.

B. Description:

1. Louvers meeting the following specifications shall be furnished and installed where shown on the plans and/or as described in schedules. Louvers too large for complete factory assembly shall be built up by the installing CONTRACTOR from factory assembled Sections. Louver frames, mullions and Section joints shall be adequately supported from the building structure to withstand this wind loading.

2. Louvers shall be acoustical stationary Airfoil blade, fabricated from aluminum. Louver frame depth shall be 12-inches (305 mm). Acoustical material shall be fiberglass insulation. Blades and frames will be mechanically fastened together. Each louver shall be equipped with a framed, removable, rear-mounted screen of flattened expanded aluminum.

3. Comprehensive louver performance data including airflow resistance, water penetration, Sound Transmission Class (STC), Outdoor Indoor Transmission Class (OITC) and free area shall be submitted for approval. Louvers must be AMCA certified for airflow resistance and water penetration. Acoustical testing must be performed by an independent laboratory.

C. Performance:

1. AMCA Performance:

a. A 4-foot by 4-foot unit (1.2-meter by 1.2-meter) shall be licensed to bear the AMCA seal, and shall conform to the following:

Free Area	Minimum 3.49 sq. ft. (.32 sq m)
Percent Free Area	Minimum 22 percent
Velocity at the Point of Beginning Water Penetration of 0.01 oz/sq. ft. (.30 ml/sq. meter)	1025 FPM (312 MPM)

2.5 FRP STATIONARY BLADE LOUVERS

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal.

a. Fixed Type FRP louvers shall be Composite Fan Technology, FRP Louvers, or equal.

B. Description:

1. Louvers shall be constructed of isophthalic polyester fire-retardant resin, equivalent to **Hetron 99P** polyester resin with a Class 1 flamespread of 25 or less.

2. Ultraviolet inhibitors shall be incorporated into the resin.

3. Louver sections shall include fiberglass unidirectional filaments and a synthetic veil.

4. Provide a minimum of 40 percent glass by weight.

5. Coloring shall be achieved by the use of pigments impregnated through the entire profile.

6. Louver frames shall be 6-inches (152 mm) deep, of the channel type, and provided with a minimum thickness of 1/4-inch (6.4 mm).

7. Louver blades shall be:

a. Of a “K” style design.
b. Provided with a minimum thickness of 1/8-inch (3.2 mm).
c. Provided with a 45-degree opening.

8. Hardware shall be fabricated from Type 306 stainless steel.

9. Provide the following accessories:

   a. A 1/2-inch (13 mm) mesh polyethylene screen mounted in a removable PVC frame.
   b. Fiberglass mullion covers.

C. Performance:

Free Area	Minimum 9.08 sq. ft. (.84 sq. m)
Percent Free Area	Minimum 57 percent
Velocity at the Point of Beginning Water Penetration of 0.01 oz/sq. ft. (.30 ml/sq. m)	1023 FPM (312 MPM)

2.6 ACCESSORIES

A. Sill Extensions/Flashing:

1. Except for FRP stationary blade louvers, sill extensions/flashing shall be one-piece, extruded 0.060, aluminum.

   a. Sill extensions/flashing for FRP stationary blade louvers shall be one-piece fiberglass reinforced plastic to match the FRP louver.

2. Sill extension/flashing finish shall be the same as louver, custom color to match adjacent exterior wall, as approved by the ENGINEER.

B. Insulated Blank-Off Panels:

1. Insulated blank-off panels shall be provided where required to seal-off louver area not connected to ductwork or to cover areas not required for free air. Insulated blank-off panels shall be provided by the louver Manufacturer and shall consist of 2-inch (50.8 mm) glass fiberboard insulation encapsulated and sealed completely in 0.032-inch (.81 mm) aluminum skins, securely fastened to louvers and ductwork.

2. Insulated blank-off panel finish shall be same as louvers, flat black in color, unless otherwise indicated.

C. Screens:

1. Bird Screen: Each exterior louver shall be provided with 3/4-inch (19 mm) by 0.051-inch (1.3 mm) mesh aluminum wire bird screen secured within rewireable extruded aluminum frame as approved. Attach to interior face of louver, unless otherwise noted.

2. Insect Screen: For exterior louvers not connected to ductwork, provide separate fiberglass insect screen, frame, and accessories mounted to interior face of bird screen.

   a. Insect screen shall be installed such that it is removable to allow for frequent maintenance and cleaning.

3. Screens shall be secured to louver frames with removable machine screws, spaced at each corner and at 12-inches (305 mm) on center, minimum, between corners

4. Screens and frames shall have same finish as louvers, color shall be black.

5. Fasteners: Fasteners shall be structural-grade aluminum. Provide materials, types, gauges, and lengths to suit unit installation conditions. Phillips flat-head machine screws shall be used for exposed features, unless otherwise indicated.

6. Anchor and inserts: Anchors and inserts shall be non-ferrous metal for exterior installations and elsewhere as required for corrosion resistance. Steel expansion bolt devices shall be used for drilled-in-place anchors. Concrete inserts shall be provided as required.

2.7 FINISH AND COLOR

A. Finish system shall be 1.2-mil (.03 mm), PVF2 Kynar 500, formulated by a licensed formulator to contain 70 percent PVF resin and applied by a licensed applicator.

1. The surface condition of this finish coat shall be 100 percent free of holidays, drip marks, scratches, roll marks, or abrasions that are visible from a distance of 5-feet (1.5 m) in good light when in installed position. Surfaces shall be free of checking, crazing, peeling, or loss of adhesion.

2. Finish shall meet or exceed AAMA 2605.

3. Color shall be selected and approved by the OWNER from Manufacturer's full color range including custom colors, and may be required to exactly match other building components, as determined by the OWNER, at no additional cost to the OWNER.

a. Tentative color selection: To be Selected.

b. The OWNER reserves the option of changing this tentative color selection during the submittal process.

2.8 FABRICATION

A. The CONTRACTOR shall field verify size, location, and placement of louvers, shall advise the ENGINEER in writing of any necessary adjustments, and shall make the necessary adjustments prior to fabrication. The CONTRACTOR shall coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments.

1. Louvers shall be assembled before shipment to the Site.

2. Accurate relation of planes and angles shall be maintained, with hairline fit of contacting members.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after installation.

B. Protect surrounding WORK from damage that may result from operations under this Section.

3.3 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

2. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units shall be rejected.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where louvers and appurtenances will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed louvers.

a. Provide inserts, backing, blocking, anchoring devices, and reinforcements that must be built into other WORK for the installation of louvers. Coordinate delivery with other WORK to avoid delay.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate CONTRACTOR'S acceptance of the substrate, areas, and conditions.

3.4 PREPARATION

A. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

3.5 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with applicable references, with the requirements of the CODE, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the ENGINEER.

B. The CONTRACTOR shall provide corrosion resistant fasteners, anchors, and shims required for a complete installation, and shall be secure, plumb, level, straight, and true to line, allowing for required movement, including expansion and contraction.

C. The CONTRACTOR shall provide separation of dissimilar materials to ensure no galvanic action occurs.

D. The CONTRACTOR shall block and reinforce walls as required to support the louvers and appurtenances.

E. Horizontal lines shall be level, and vertical lines shall be plumb.

F. Sill extensions shall be provided at exterior louver installations.

3.6 CLEANING, FINISHING, AND PROTECTION

A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of the CONTRACTOR.

2. Residue shall not be left on any surfaces.

B. Upon completion of the installation, louvers and appurtenances shall be cleaned of dirt and other foreign matter to the satisfaction of the ENGINEER.

1. Cleaning shall be performed again immediately prior to acceptance of the WORK, when directed by the ENGINEER.

2. Cleaning shall be performed in accordance with the Manufacturer's written instructions.

C. Louvers shall be protected from damage from subsequent construction operations.

D. The CONTRACTOR shall make adjustments required and retest until accepted.

E. The CONTRACTOR shall remove scratches and blemishes to the satisfaction of the ENGINEER.

F. Damaged or defective items shall be removed and replaced at the direction of the ENGINEER.

G. When louver WORK is completed, remove unused materials, containers, and equipment, and clean the Site of louver debris.

END OF SECTION

SECTION 09 29 00 – GYPSUM BOARD

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide gypsum board and appurtenant WORK, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. American Society of Testing and Materials (ASTM):

1. ASTM A 36 Standard Specification for Carbon Structural Steel
2. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
3. ASTM C 36 Standard Specification for Gypsum Wallboard
4. ASTM C 475 Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
5. ASTM C 518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
6. ASTM C 578 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
7. ASTM C 645 Standard Specification for Nonstructural Steel Framing Members
8. ASTM C 754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
9. ASTM C 840 Standard Specification for Application and Finishing of Gypsum Board.
10. ASTM C 1325 Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement Substrate Sheets
11. ASTM D 2626 Standard Specification for Asphalt Saturated and Coated Organic Felt Base Sheet Used in Roofing
12. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in and Environmental Chamber
13. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
14. ASTM E 96 Standard Test Method for Water Vapor Transmission of Materials

15. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Materials

16. ASTM E 136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C

17. ASTM E 1677 Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls

C. Building Code: Refer to the Drawings to determine which Building Code applies. The applicable Building Code, defined by the Drawings, is referenced to herein as "the CODE."

D. Federal Specifications:

1. QQ-W-461H Wire, Steel, Carbon (Round, Bare, and Coated)

E. Gypsum Association:

1. GA-203 Installation of Screw-Type Steel Framing Members to Receive Gypsum Board
2. GA-216 Recommended Specifications for the Application and Finishing of Gypsum Board
3. GA-253 Recommended Specification for the Application of Gypsum Sheathing.
4. GA-600 Fire Resistance Design Manual

F. Technical Association of Pulp and Paper Industry (TAPPI)

G. Underwriters Laboratories (UL): Fire Resistance Directory.

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Literature: Manufacturer's specifications, technical data, installation methods, and maintenance instructions.

C. Warranty: Submit a copy of the warranties.

D. Certifications:

1. Certification of compliance with the UL specifications where required.

2. Certification of recycled content as required for select materials herein.

3. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, and contact information of the consultant firm of record, general contractor, and owner.

E. Shop Drawings: Complete Shop Drawings showing location and detail of installation.

1. Shop Drawings shall be drawn to sufficient scale and shall include dimensions, show plans, elevations, and details of construction of each board type, location and installation requirements, thickness of materials, joints, provisions for expansion and contraction, connections, accessories, and trim.

2. Shop drawings shall show installation conditions at adjacent construction, and shall include indications for anchorage devices, blocking, backing, insulation and reinforcement built into the WORK for securing items furnished under other Sections.

F. Samples: When requested by the ENGINEER, submit samples of the materials proposed. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by the ENGINEER. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the CONTRACTOR from compliance with the Contract Documents.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility:

1. Gypsum board shall be provided by a single Manufacturer, each.

2. Framing and accessories shall be provided by a single Manufacturer, each.

3. Tape, adhesives, joint and finishing compounds shall be provided by a single Manufacturer, each.

B. Installer Qualifications:

1. A minimum of 5 years' experience in the successful completion of at least 5 projects of similar size and scope, employing similar products, materials, applications, and performance requirements.

2. Installers without these qualifications will not be accepted.

C. WORK of this Section shall conform to applicable portions of GA-203, GA-216, GA-253, and GA-600.

1.5 SPECIAL WARRANTY PROVISIONS

A. Furnish Manufacturer's 5-year written warranty to cover defects in materials, products, and manufacturing workmanship.

B. CONTRACTOR shall furnish separate, but concurrently running, 5-year written warranty to cover labor.

C. Warranties shall be non-prorated for the entire warranty period.

D. The term of the warranties shall begin on the date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL

A. Gypsum board, framing, and appurtenances shall be recommended by the Manufacturer for the installation indicated.

B. Gypsum board, framing, and appurtenances shall be suitable for, and compatible with, the required installation.

C. Labeling and Certification: Fire rated materials shall bear testing agency labels and required fire classification numbers.

2.2 FRAMING MEMBERS (FURRING AND NON-LOADBEARING MEMBERS)

A. Manufacturer, or Equal:

1. Subject to the requirements indicated, provide products from the Manufacturer listed below, or equal.

a. Dietrich Metal Framing.

B. Description:

1. Galvanize all steel components to ASTM A 653, G60 Standards, unless otherwise indicated.

2. Studs – ASTM C 645, 20-gauge, C-shape, 3-5/8-inch (92 mm) depth unless otherwise indicated, or required.

a. Stud System Accessories – Provide stud Manufacturer's standard clips, shoes, ties, reinforcements, fasteners, and other accessories as required for a complete stud system.

3. Runners – ASTM C 645 to match studs; type recommended by stud Manufacturer for floor and head support of studs, and for vertical abutment of gypsum board at other WORK.

a. Provide slip-type deflection track detail to allow for deck and/or structural member deflection at connections to underside of structure.

b. Provide UL listed “Fire Track® System” in required sizes, profiles, and configuration and with necessary accessories (including Fire Track Posi-Clips® if required) by Fire Track Corp., 1-800-394-9875, or equal, for deflection track at fire rated partitions as required.

4. Furring Channels – ASTM C 645, 25-gauge, 2-inch (51 mm) web and flanges – Z-shaped furring channels to receive insulation board; 2-inch (51 mm) hat channels may be used for furred substrates not receiving insulation board.

5. Tie wire or clips used for securing cross-furring to primary members shall be galvanized, soft annealed steel wire. The weight of galvanizing shall be not less than Class 1 as set forth in Federal Specifications QQ-W-461H. Tie wire gauge shall be as set forth in the CODE.

6. Wire hangers supporting main runners in suspended ceilings shall be galvanized steel and the weight of galvanizing shall be not less than Class 1 as set forth in Federal Specifications QQ-W-461H. The gauge of galvanized steel hanger wire shall be as required by the CODE.

2.3 GYPSUM BOARD

A. Manufacturer, or Equal:

1. Subject to the requirements indicated, provide products from one of the Manufacturers listed below, or equal.

a. GP Gypsum Corporation.
b. National Gypsum Company.
c. United Stated Gypsum Company.

B. Gypsum board shall comply with ASTM C 36.

C. Gypsum board shall be 5/8-inches (16 mm) thick with rounded, tapered edges, unless otherwise indicated.

D. Gypsum board shall be fire rated “Type X,” unless otherwise indicated.

2.4 GYPSUM BOARD ACCESSORIES

A. Tape, joint compound, and finishing compound shall comply with ASTM C 475, and shall be compatible with the gypsum board, as recommended by the gypsum board Manufacturer.

1. Tape shall be fiberglass reinforcing tape.

B. Adhesives for fastening gypsum board-to-gypsum board shall be in accordance with the printed recommendations of the gypsum board Manufacturer.

C. Concealed sealant shall be mastic type, non-shrinking, non-drying, non-migrating, and non-staining, approved for use by the gypsum board Manufacturer.

D. Metal Accessories: Except as otherwise indicated, provide Manufacturer's standard galvanized steel beaded units with face flanges for concealment in joint compound, including corner beads, casing beads, control joints, and edge trim.

1. Provide additional special accessories and shapes as required.

E. Reinforcing for Applied Items:

1. Light-duty applications – minimum 14-gauge galvanized steel sheet attachment plate for toggle bolt applications, unless otherwise indicated.

2. Heavy-duty applications – ASTM A 36 galvanized steel in required thicknesses and shapes with required fasteners.

F. Fasteners shall be corrosion resistant coated complying with the referenced standards.

1. Screws shall be self-drilling, self-tapping, bugle head for use with power tools, length as recommended by Gypsum Association and the CODE.

a. Type “S” for board-to-sheet metal application.
b. Type “G” for board-to-board application.

2.5 INSULATION

A. Insulation for furred masonry walls shall be two layers of 1-inch (25 mm) ("TUFF-R" rigid, foil faced, polyisocyanurate with an R-Value of 6.5 (min) by Celotex, or approved equal. Provide with Manufacturer's compatible foil tape.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

1. Store in dry, well-ventilated space, protected from moisture and humidity.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 PREINSTALLATION CONFERENCE

A. The WORK of the Section shall be carefully coordinated with the WORK of all other related trades including materials to be built into or applied on gypsum board and items requiring additional supports within partitions.

B. The CONTRACTOR shall meet at the site with the installers of related WORK and review the coordination and sequencing of WORK to ensure that everything to be concealed by WORK of this Section has been accomplished, and that chases, access panels, openings, supplementary framing and blocking, and similar provisions have been completed.

3.3 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions, referenced standards, for environmental conditions before, during, and after installation.

1. Building and areas receiving gypsum board WORK shall be completely dried-in and adjoining materials shall be sufficiently dry before starting or continuing gypsum board installation.

2. All windows, doors, roofing, and other waterproofing and weather proofing cladding and components of the building shell shall in place and complete.

3. Gypsum board shall not be exposed to moisture, excessive or continuous humidity, or water at any time.

4. Maintain a minimum room temperature of 55 degrees F, during application of gypsum board and joint treatment until completely dry or occupied.

5. Provide adequate ventilation as required.

B. Protect surrounding WORK from damage that may result from operations under this Section.

3.4 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

2. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units shall be rejected.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where gypsum board, framing, and appurtenances will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed gypsum board.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate CONTRACTOR'S acceptance of the substrate, areas, and conditions.

3.5 PREPARATION

A. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

3.6 INSTALLATION – GENERAL

A. Installation shall comply with the requirements of the Contract Documents, with the requirements of the CODE, with applicable references, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the ENGINEER.

1. Fire rated assemblies shall be installed in accordance with GA-600 and UL Fire Resistance Directory.

B. The CONTRACTOR shall provide corrosion resistant fasteners, anchors, and shims required for a complete installation, and shall be secure, plumb, and true to line, allowing for required movement, including expansion and contraction.

C. The CONTRACTOR shall provide separation of dissimilar materials to ensure no galvanic action occurs.

D. Horizontal lines shall be level, and vertical lines shall be plumb.

E. Coordinate location of concealed supplemental blocking, backing, and additional anchoring reinforcement with items furnished under other Sections.

3.7 INSTALLATION – FRAMING (FURRING AND NON-LOADBEARING PARITIONS)

A. Partition framing and gypsum board shall extent to underside of structure, unless otherwise indicated.

B. Installation of framing shall be in accordance with ASTM C 754 and the CODE.

C. Provide slip-type deflection track at all head connections to underside of structure. Provide for deflection allowance of 1 1/2-inches (38 mm) minimum, unless otherwise indicated.

D. Align runner tracks to the partition layout at both floors and ceilings. Secure tracks to floor and overhead structure 16-inches (406 mm) on center, maximum. Provide fasteners at all corners and ends of runner tracks.

E. Full-length studs shall be provided to span the height between runner tracks. Spliced units shall not be allowed. Friction fit studs to runner tracks by positioning and rotating into place. Provide positive attachment to runner tracks for studs located at partition corners and intersections and adjacent to openings, using 3/8-inch (9.5 mm) self-drilling screws at both flanges and studs.

1. Space studs at 16-inches (406 mm) on center, unless otherwise indicated.

F. Provide additional studs to support corners at partition intersections and corners, and to support outside corners, terminations of partitions, and both sides of control joints. Provide any additional bracing and reinforcing members as recommended by the system Manufacturer to provide complete rigidity at partitions.

G. At openings and doorframes, install two full height studs at all jambs. Fasten the first stud at each jamb with two self-drilling screws to all frame joint anchors. Place second stud in tandem with and against first stud.

H. Above openings and heads of frames, a cut-to-length section of track shall be installed. Flanges shall overlap jamb studs and shall be securely attached to jamb studs.

I. Between frames and ceiling, install cut-to-length jack studs, extending from doorframe header track to ceiling track. Where control joint is called for at jamb line above frame, install jack stud approximately 1-inch (25 mm) from first jamb stud. At all other locations keep jack studs at least 6-inches (152 mm) from jambs to avoid gypsum board joints at jamb line.

J. Install reinforcing for applied items, such as supplementary framing, runners, furring, blocking, and bracing at openings and terminations in the WORK, and at locations required to support fixtures, accessories, equipment, services, heavy trim, furnishings, and similar WORK that cannot be adequately supported directly on gypsum board alone.

1. Attention is directed to electrical equipment, toilet partitions, lockers, and toilet and shower accessories requiring additional support. Coordinate these requirements with the respective trade sections for exact locations.

K. At furred masonry walls, install rigid insulation board between furring strips, friction fit, butt joints tight with foil facing CMU. Install multiple layers with staggered joints as required to achieve thickness indicated. Seal all joints prior to installation of gypsum board.

L. Tolerances: Provide framing such that tolerances are 1/16-inch (1.6 mm) maximum offset between planes of gypsum board faces and 1/8-inch (3.2 mm) in 8-feet (2.4 m) for plumb, level, warp, and bow, unless otherwise indicated.

3.8 INSTALLATION – GYPSUM BOARD GENERAL

A. Install gypsum board to minimize joints. When joints are necessary, butt tapered joints together; end joints shall be avoided and kept to a minimum.

1. Boards shall be brought into contact with each other but shall not be forced into place. Joints on opposite sides of a partition shall not occur on the same stud.

2. Provide expansion joints as shown, as recommended per applicable references, and as directed.

B. Where gypsum board abuts other materials, such as masonry walls, structural frame, and decking, the gypsum board shall be held back so as to form a joint, which shall be sealed with acoustical or fire rated sealant as required for the condition.

1. Isolate edges of gypsum board 1/2-inch (13 mm) from abutment with structure, particularly at slabs on grade. Provide trim and caulk with sealant.

C. Fasteners:

1. Gypsum board shall be screw-fastened to framing.

a. Screws shall be spaced not to exceed 12-inches (305 mm) on center except at vertical butting edges of the fire-rated partitions where they shall be 8-inches (203 mm) on center.

b. Space fasteners in accordance with applicable reference standards and Manufacturer's recommendations, except as otherwise indicated.

D. Single Layer Construction: Gypsum board shall be held in firm contact with framing member while fastenings are being driven. Fastening shall proceed from center portion of the gypsum board toward the edges and ends. Fasteners shall be set with heads slightly below the surface of the gypsum board in the dimple formed by the power screwdriver. Care shall be taken to avoid the breaking of the face paper of the gypsum board. Improperly driven screws shall be removed.

E. Metal Accessories:

1. Metal edge trim shall be provided whenever edge of gypsum board would otherwise be exposed or semi-exposed, at all discontinued edges, where abutting with another material, and where otherwise indicated or required.

2. Corner beads shall be provided at all exterior corners.

3. Metal accessories shall be set plumb, level, straight and true and shall be shimmed where necessary. The accessories shall be mitered at corners; exposed joints shall be accurately and tightly fitted. Sections shall be installed in lengths as long as practicable, and splices shall be held to a minimum.

4. Metal accessories shall be screw-fastened to framing members with screws spaced not more than 9-inches (229 mm) apart.

5. Where feasible, use the same fasteners to anchor metal accessories as required to fasten gypsum board to framing.

F. Upon completion, gypsum board shall form a smooth, firm flat plane free from ripples, waves, buckles, bumps, and projecting edges.

3.9 GYPSUM BOARD FINISHING

A. Gypsum board shall be taped, and all screw heads, penetrations, joints, end trim, corner beads, fastener, and other depressions shall be treated with joint and finishing compounds applied per applicable references and per Manufacturer's printed recommendations for three-coat WORK.

B. Finish gypsum WORK in accordance with ASTM C 840, to Level 4 of Gypsum Association GA-214, and the following:

1. Joint compound shall be mixed in accordance with Manufacturer's instructions. A uniform layer of compound shall be applied over the joint approximately 4-inches (102 mm) wide and filling the groove. The tape shall be centered over the joint and embedded into the compound leaving sufficient compound under tape to provide proper bond.

2. A second and third coat of joint compound or joint finishing compound shall be applied after each preceding coat has been allowed to thoroughly dry. Coats shall be spread over tape and the tapered portion of edge and feathered out at the edge.

3. All inside corners shall be coated with at least one coat of joint compound over perforated tape with the edges feathered out.

4. All screw head dimples shall receive at least three coats of compound.

5. Flanges of corner and casing beads shall be concealed by at least two coats of compound feathered out approximately 9-in (229 mm) on one or both sides of the exposed metal as applicable.

6. Allow each application of compound to joints and fastener heads to dry, then sand as required.

7. Caution shall be used to avoid roughing of the gypsum board paper. All gypsum board and treated areas shall be left smooth and ready for painting.

8. Gypsum board shall be sanded smooth, dusted, and provided with a textured orange peel finish coat.

9. Joints and penetrations in gypsum board at non-visible locations, such as within attics or in ceiling plenums shall receive joint treatment, shall be taped, and joints shall be caulked with sealant. Additional treatment to comply with the required fire ratings shall be provided.

3.10 CLEANING, FINISHING, AND PROTECTION

A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of the CONTRACTOR.

2. Residue shall not be left on any surfaces.

B. Gypsum board shall be protected from damage from subsequent construction operations.

C. The CONTRACTOR shall make adjustments required until accepted.

D. Damaged or defective items shall be removed and replaced at the direction of the ENGINEER.

E. When gypsum board WORK is completed, remove unused materials, containers, and equipment, and clean the Site of gypsum board debris.

END OF SECTION

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SECTION 09 30 13 – CERAMIC TILE

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide ceramic tile and appurtenant WORK, complete and in place, in accordance with the Contract Documents.

B. The CONTRACTOR shall coordinate color samples with other Sections through the submittal process.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. Americans with Disabilities Act (ADA):

ADAAG	Americans with Disabilities Accessibility Guidelines

C. American Society of Testing and Materials (ASTM):

ASTM C 241	Standard Test Method for Determining Abrasion Resistance of Stone Subjected to Foot Traffic
ASTM C 503	Standard Specification for Marble Dimension Stone
ASTM C 1028	Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
ASTM F 2170	Standard Test Method for Determining Relative Humidity in Concrete Slabs using In Situ Probes

D. American National Standards Institute (ANSI):

ANSI A 108.5	Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar
ANSI A 108.10	Installation of Grout in Tile WORK
ANSI A 118.4	Latex-Portland Cement Mortar
ANSI A 118.7	Specification for Polymer Modified Tile Grouts for Tile Installation
ANSI A 137.1	Standard Specification for Ceramic Tile

E. Building CODE: Refer to the Drawings to determine which building code applies within a given jurisdiction. The applicable building code, defined by the Drawings, is referred to herein as “the CODE.”

F. Marble Institute of America (MIA): Dimension Stone Design Manual IV.

G. South Coast Air Quality Management District (SCAQMD):

SCAQMD Rule No. 1168

H. Tile Council of America (TCA): Handbook for Ceramic Tile Installation (CIT).

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Literature: Manufacturer's specifications, technical data, installation methods, and maintenance instructions, and the following:

1. Tile Manufacturer's standard color charts for color selection by the OWNER.
2. Grout Manufacturer's standard color charts for color selection by the OWNER.

C. Warranty: Submit a copy of the warranty.

D. Certifications:

1. Certification by the tile Manufacturer that the tile materials provided are suitable for, and compatible with, the required installation.

2. Master Grade Certificate for each shipment, stating the grade, type, and composition of tile, identification marks for tile packages, and the name and location of the project.

a. The certificates shall be signed by the tile Manufacturer and installer and shall be issued when tile is shipped, before beginning any tile WORK.

b. The certificate shall show that the tile, mortar, and grout complies with the requirements of the Tile Council of America Inc. (TCA).

c. Adequate information shall be included on the certificate for identifying corresponding shipping packages.

d. Include certifications and other data as may be required to show compliance with these specifications.

3. Certification of recycled content as required for select materials herein.

4. Independent certification that the products comply with the VOC limits and VOC performance criteria indicated.

5. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, and contact information of the consultant firm of record, general contractor and owner.

6. Certification that the required substrate tests have been performed, and that the substrates are suitable for the installation.

E. Shop Drawings: Complete shop drawings showing location and detail of installation.

1. Include details, tile layout, colors and pattern distribution.

2. Show ceramic tile control joints and demonstrate coordination with substrate control joint locations.

F. Samples: The CONTRACTOR shall submit 2 samples of each of the following. Unless otherwise indicated, samples shall be full size and shall show configuration, construction, finish and color proposed for the various components. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by the ENGINEER. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the CONTRACTOR from compliance with the Contract Documents.

1. Panel sample of each tile type, showing specified finish and color, mounted on not less than 16-inch (41 cm) square plywood or hardboard backing and grouted as required.

2. Sample palettes of each grout type, showing full color range. Each individual grout sample shall be 6-inches (15 cm) long by 3/8-inch (9.65 mm) wide.

3. Representative samples of specified marble thresholds, 6-inches (15 cm) long by width indicated.

1.4 QUALITY ASSURANCE

A. Product Certificates: Tile shall be delivered with quality certificates of the Tile Council of America (TCA) and shall meet the CODE requirements.

B. Single Source Responsibility:

1. Ceramic tile shall be provided by a single Manufacturer. Each color, grade, finish, type, composition, and variety of tile shall be obtained from a single production run.

2. Ingredients for each mortar, adhesive, and grout component shall be obtained from a single Manufacturer and each aggregate shall be from one source or producer.

3. Mortar and grout shall be provided from a single Manufacturer, each.

4. Shower receptors shall be provided from a single Manufacturer.

C. Installer Qualifications:

1. A minimum of 5 years' experience in the successful completion of at least 5 projects of similar size and scope, employing similar products, materials, applications, and performance requirements.

2. Installers without these qualifications will not be accepted.

D. Tile WORK shall be not less than standards and references established within the CIT by the TCA.

E. Tile installation shall conform to ANSI A 108.5 as indicated for tile and A 108.10 for grouting.

F. Sample Mock-Up:

1. Prior to installation, erect sample mock-up of the floor and wall tile using materials and details required for final WORK. The panel shall be approximately 6-feet (1.8 m) long by 4-feet high (1.2 m). The sample mock-up shall show the workmanship, joints, colors, layout and pattern of the ceramic tile.

2. The sample panel shall be erected in a location as designated by the ENGINEER.

a. The sample panel may be constructed as part of the WORK, but must be constructed to the satisfaction of the ENGINEER prior to acceptance of the panel, and must be accepted prior to proceeding with the remainder of the Ceramic Tile WORK.

b. If the sample mock-up is provided separate from the WORK, retain mock-up during construction as a standard for judging completed WORK. Do not alter, move, or destroy mock-up until WORK is completed.

3. Obtain ENGINEER's acceptance of qualities of mock-up before installation. Modify and/or reconstruct sample mock-up at the direction of the ENGINEER until acceptance.

4. Acceptance of sample mock-up shall not relieve the CONTRACTOR from compliance with the Contract Documents.

1.5 SPECIAL WARRANTY PROVISIONS

A. Ceramic Tile: Furnish Manufacturer's 2 year written warranty to cover defects in materials, products, and manufacturing workmanship. The term of the warranty shall begin on the date of Substantial Completion.

1.6 EXTRA MATERIALS

A. Provide 1-square foot (meter) for each type of tile being provided for the WORK for future maintenance and replacement. Provide extra materials separately packaged, identified, and left with the OWNER.

B. Extra materials shall be provided from the same production run as the materials installed.

PART 2 PRODUCTS

2.1 GENERAL

A. Ceramic tile shall comply with ANSI A 137.1.

B. Ceramic tile adhesives, sealants, and sealant primers shall be low VOC per SCAQMD Rule No. 1168.

2.2 CERAMIC TILE (WALL TILE)

A. Manufacturer and Product, or Equal:

1. Subject to the requirements herein, provide products from the Manufacturer listed below, or equal.

a. DalTile Corporation, American Olean Bright Wall Tile, unless otherwise indicated.

B. Description:

1. Wall tile shall be 4 1/4-inches (108 mm) square, 5/16-inch (7.9 mm) thick, cushion edge, bright glaze (glossy).

2. Provide with required shapes such as cove base, bullnose, angle, and other trim items matching tile as required.

3. Provide in Color Group 1.

4. Installation shall be on concrete masonry units.

2.3 CERAMIC TILE (FLOOR TILE)

A. Manufacturer and Product, or Equal:

1. Subject to the requirements herein, provide products from the Manufacturer listed below, or equal.

a. DalTile Corporation, American Olean Unglazed Ceramic Mosaic floor tile.

B. Description:

1. Toilet, Shower, and Locker Rooms: Floor tile shall be mosaic, 2-inches square (51 mm), 1/4-inch thick (6.35 mm), cushion edge, unglazed vitreous tile.

2. Provide cove base as indicated for wall tile above.

3. Provide in Color Group 2.

4. Floor tile shall have the following characteristics:

Performance Characteristics	Mosaic floor tile
ASTM C 1028 Coefficient of Friction (COF)	≥ 0.60 wet; ≥ 0.70 dry
Moisture Absorption	< 3.0 percent
Breaking Strength	>250lb
Abrasion Resistance	4

2.4 TILE COLOR GROUPS

A. Color of tile shall be as selected and approved by the OWNER from Manufacturer's full color range.

1. Tentative color selection: The OWNER reserves the option of changing this tentative color selection during the submittal process.

	Color Group 1	Color Group 2
Color A	Designer White 61	Storm Gray A40
Color B	Storm Gray 40	To Be Selected
Color C	Navy 117	To Be Selected

2. Final colors, pattern, and appearance shall be selected and approved by the OWNER prior to installation.

2.5 MORTAR

A. Dry-set mortar (walls) shall conform to ANSI A 118.1 and shall have the TCA hallmark.

B. Latex-Portland cement mortar (floors) shall conform to ANSI A 118.4 and shall have the TCA hallmark.

2.6 GROUT

A. Polymer modified grout (walls and floor) shall conform to shall conform to ANSI A 118.7.

B. Color of grout shall be as selected and approved by the OWNER

C. , prior to installation.

2.7 GROUT SEALER

A. Grout sealer shall be low VOC per SCAQMD Rule No. 1168, clear penetrating type, as recommended by grout Manufacturer.

2.8 MIX WATER

A. Water shall be fresh, clean, potable, and shall be free from organic matter, acids, and alkalis.

2.9 MARBLE THRESHOLDS

A. Marble thresholds shall comply with ASTM C 503, and shall be classified Group A per definitions for soundness per MIA "Dimension Stone Design Manual IV."

B. Coefficients of Friction (COF) for marble thresholds shall be as indicated above for floor tile. Marble abrasion shall be not less than 12.0 when tested in accordance with ASTM C 241. Marble thresholds shall comply with 36 CFR 1191 for coefficient of friction for interior floors.

C. Marble thresholds shall be honed, solid marble, white color, in size, and configuration as indicated.

2.10 SHOWER RECEPTORS

A. Manufacturer and Product, or Equal:

1. Subject to the requirements herein, provide products from the Manufacturer listed below, or equal.

a. ADAAG compliant units shall be Fiat Products, Model WTR series, custom sized to fit in shower area.

b. Non-ADAAG compliant units shall be Fiat Products, Model Monterey MFTD Series, custom sized to fit in shower area.

B. Description:

1. Custom-sized, precast terrazzo unit made of black and white marble chips cast in white Portland cement with a compressive strength of not less than 3,000 psi (21 MPa).

2. Terrazzo surface shall be ground and polished with air holes and/or pits grouted and the excess material casting removed.

3. Tiling flange cast integral shall be galvanized-bonderized steel and shall extend not less than one-inch above shoulder.

4. Drain body shall be stainless steel cast integral, and shall provide for a caulked lead connection not less than one-inch deep to a 2-inch pipe (51 mm), or a quick drain connection using a QDC-4 connector and shall include a removable stainless steel or brass strainer plate.

5. For ADAAG compliant units, receptor shall have integral stainless steel entry cap and receptor threshold entry height shall be 1/2-inch (13 mm), complying with ADAAG. Shoulder shall not be less than 4-inches (102 mm) high inside, 6-inches (152 mm) high outside and not less than 3-inches (76 mm) wide.

C. Fabrication: The CONTRACTOR shall field verify size, location, and placement of shower receptors, shall advise the ENGINEER in writing of any necessary adjustments, and shall make the necessary adjustments prior to fabrication. The CONTRACTOR shall coordinate field measurements and shop drawings with fabrication and shop assembly to minimize field adjustments.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

2. Exposed surfaces that exhibit pitting, stains, discoloration, or other surface imperfections on the finished units shall be rejected.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where tile will be installed for compliance with requirements for installation, taking into account tolerances, and other conditions affecting performance of installed tile.

a. Substrates for setting tile shall be firm, sound, dimensionally stable, dry, clean, free from oil, waxy films, and curing compounds; and shall be within flatness tolerances required by referenced standards.

b. Perform substrate humidity test in accordance with ASTM F 2170. Comply with tile Manufacturer's written instructions to achieve acceptable relative humidity levels in the concrete slab prior to applying flooring materials. In no case should the humidity levels in the slab be greater than 75 percent, prior to applying materials.

c. Installation of grounds, anchors, recessed frames, electrical and mechanical units of WORK, and similar items located in or behind tile shall be completed before installing tile.

d. Joints and cracks in tile substrates shall be coordinated with tile movement joint locations.

e. For wall tile, maximum variation in tile substrate shall be 1/8-inch (32 mm) from the required plane in 8-feet (2.4 m) of wall.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate CONTRACTOR's acceptance of the substrate, areas, and conditions.

3.3 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions, TCA, and ANSI standards for environmental conditions before, during, and after application.

1. Do not install tile until areas have been fully enclosed and environmental conditions have reached the levels indicated during occupancy.

2. Maintain ambient temperature and humidity conditions during and after installation of tile at levels indicated during occupancy.

3. Allow tile to reach room temperature or minimum temperature recommended by Manufacturer before beginning installation.

4. Protect adhesives from freezing. Follow Manufacturer's recommendations for minimum temperatures to which adhesives are exposed.

B. Protect surrounding WORK from damage that may result from operations under this Section.

3.4 SURFACE PREPARATION

A. Surface preparation shall be in compliance with the referenced standards, and with the Manufacturer's written instructions.

B. Coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials shall be removed by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

C. Where concrete substrates are indicated, provide latex-Portland cement mortars that comply with flatness tolerances in ANSI A 108.

D. Protrusions, bumps, ridges, and loose substrate surface materials shall be removed by sanding or grinding.

E. Trowelable leveling and patching compounds shall be used per tile Manufacturer's written instructions to fill cracks, holes, and depressions.

F. Immediately before application of tile materials, scrape surfaces to be covered free from foreign materials and brush clean.

G. Substrate shall be swept to remove all loose materials prior to beginning ceramic tile installation.

3.5 PREPARATION

A. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

B. Blending Tile: For tile exhibiting color variations within the ranges selected during sample submittals, The CONTRACTOR shall verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in colors as those taken

from other packages and match approved samples. If not factory blended, tile shall either be returned to Manufacturer or blended at Site to the satisfaction of the ENGINEER before installing.

C. Jointing Pattern: Tile shall be laid in grid pattern, unless otherwise indicated. Joints shall be aligned when adjoining tiles on floor, base, walls, and trim are the same size. Tile WORK shall be laid out with tile fields centered in both directions in each space or on each wall area. Align joints to give straight uniform grout lines, plumb, and level. Align floor joints to give straight uniform grout lines parallel with walls. Adjustments shall be made to minimize tile cutting. Uniform joint widths shall be provided, unless otherwise indicated. Make joints between tile sheets same width as joints within sheets, so that extent of each sheet is not apparent in finished WORK.

D. Movement Joints:

1. Expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, shall be located where indicated during installation of setting materials, mortar beds, and tile. Joints shall not be saw-cut after installing tiles.

   a. Joints shall be located in tile surfaces directly above joints in concrete substrates.

   b. Joints shall be prepared and sealants shall be applied to comply with Section 07 92 13 - Sealants and Caulking.

E. Mortar and Grout Mixing:

1. Mortars and grouts shall be mixed to comply with referenced standards and to comply with mortar and grout Manufacturer's written instructions.

2. Materials, water, and additives shall be added in accurate proportions.

3. The CONTRACTOR shall use mixing equipment, mixer speeds, mixing containers, mixing time, and procedures to produce mortars and grouts of uniform quality with optimum performance characteristics.

F. Cut edges clean before installing tile. Fit tile carefully against trim, accessories, ground pipes, electric boxes, and other built-in fixtures so that escutcheons, plates, and collars will completely overlap cut edges.

3.6 INSTALLATION – WALL TILE

A. Installation shall comply with the requirements of the Contract Documents, with the requirements of the CODE, with ADAAG, with applicable references, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as determined by the ENGINEER.

B. Install wall tile in accordance with ANSI A 108.5 and TCA Method W 244.

C. Install grout per ANSI A 108.10.

D. Set tile in minimum notched bed of 3/32-inch (2.4 mm) thickness trowel

E. Should some “flash-patching” be necessary to alleviate minor unit-to-unit variance in masonry back-up, the addition of fine-screened sand in recommended proportion will be allowed. No other modification of the Manufacturer's formulation will be permitted.

F. Walls Tile Joint Widths: 1/16-inch (1.6 mm), unless otherwise indicated.

3.7 INSTALLATION – FLOOR TILE AND MARBLE THRESHOLDS

A. Installation shall comply with the requirements of the Contract Documents, with the requirements of the CODE, with ADAAG, with applicable references, and with Manufacturer’s written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the ENGINEER.

B. Install floor tile per ANSI A 108.5 and TCA Method F113.

C. Install grout per ANSI A 108.10.

D. Floor Tile Joint Widths: Mosaic Floor Tile: 1/8-inch (3.2 mm), unless otherwise indicated.

E. Thresholds shall be installed at locations indicated; thresholds shall be set in same type of setting bed as abutting field tile, unless otherwise indicated.

1. Thresholds shall be set in latex-Portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent non-tile floor finish.

3.8 GROUTING

A. Grout joints full to the bottom of the rounded edge of the bevel or flush at square edge tile. Grout shall be forced into joints according to Manufacturer's instructions. Joints shall be sponged and tooled. Fog grouting as required for proper curing.

B. Provide open joints for sealant where required.

3.9 INSTALLATION – SHOWER RECEPTOR

A. Installation shall comply with the requirements of the Contract Documents, with the requirements of the CODE, with applicable references, and with Manufacturer’s written instructions. Additionally, shower receptors installed in handicapped accessible showers, where indicated, shall comply with ADAAG. Where a conflict occurs among these requirements, the more stringent shall apply, as determined by the ENGINEER.

3.10 CLEANING, FINISHING, AND PROTECTION

A. Cleaning:

1. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

a. Remove masking film and temporary labels as soon as possible after installation. Film and labels left in place after installation shall be the responsibility of the CONTRACTOR.

b. Latex-Portland cement grout residue shall be removed from tile as soon as possible.

c. Residue shall not be left on any surfaces

2. Upon completion of the installation, ceramic tile and appurtenances shall be cleaned of all dirt, adhesives, and other foreign matter to the satisfaction of the ENGINEER.

   a. Cleaning shall be performed again immediately prior to acceptance of the WORK, when directed by the ENGINEER.

   b. Cleaning shall be performed in accordance with the Manufacturer's written instructions.

3. Before final inspection, protective coverings shall be removed and neutral cleaner shall be rinsed from tile surfaces.

B. Finishing: Finished installation shall be left clean and free of cracked, chipped, broken, nonbonded, and otherwise defective tile WORK.

C. Protection:

1. Ceramic tile shall be protected from damage from subsequent construction operations.

   a. Protect the WORK at all times and arrange for the closing off of traffic and other WORK when this is necessary to avoid damage to finished surfaces.

   b. When recommended by tile Manufacturer, a protective coat of neutral protective cleaner shall be applied to completed tile walls and floors. Installed tile shall be protected with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

   c. Foot and wheel traffic shall be prohibited from tiled floors for at least 7 days after grouting is completed, and be allowed thereafter only after approval of Installer.

D. The CONTRACTOR shall remove scratches and blemishes to the satisfaction of the ENGINEER.

E. Damaged or defective items shall be removed and replaced at the direction of the ENGINEER.

F. When ceramic tile WORK is completed, remove unused materials, containers, and equipment, and clean the Site of ceramic tile debris.

END OF SECTION

SECTION 09 51 13 – SUSPENDED ACOUSTICAL TILE

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide suspended acoustical tile and appurtenant WORK, complete and in place, in accordance with the Contract Documents.

B. The CONTRACTOR shall furnish professional design and engineering services as required for metal wall, roof and soffit panels, accessories and appurtenances as indicated herein.

1. Professional design and engineering services may be provided by the Manufacturer or by an independent licensed civil engineer retained by the CONTRACTOR, either of which shall comply with the requirements indicated.

C. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. Acoustical Material Association (AMA): Specification for Acoustical Tile and Lay-in Panel Ceiling Suspension Systems

C. American Society of Testing and Materials (ASTM):

ASTM A 580/580M Standard Specification for Stainless Steel Wire

ASTM A 641/A 641M Zinc-Coated (Galvanized) Carbon Steel Wire

ASTM A 653/653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 1008/1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

ASTM B 633 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM C 635 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

ASTM C 1414 Standard Test Method for Airborne Sound Attenuation between Rooms sharing a Common Ceiling Plenum

ASTM C 834 Standard Specification for Latex Sealing Compounds

ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E 580 Application of Ceiling Suspension Systems from Acoustic Tile and Lay-in Panels in Areas Requiring Seismic Restraint

ASTM E 1264 Standard Classification for Acoustical Ceiling Products

ASTM E 1477 Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers

D. Building Code: Refer to the Drawings to determine which building code applies. The applicable building code, defined by the Drawings, is referenced herein as "the CODE."

1.3 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals:

1. Literature: Manufacturer's specifications, technical data, installation methods, and maintenance instructions.

2. Warranty: Submit a copy of the warranty.

3. Certification:

a. Certification of compliance with the requirements of 2.1.A.

1) Include The Code Evaluation Report for seismic performance.

b. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, and contact information of the consultant firm of record, general contractor and owner.

c. Certificate attesting that the mineral based acoustical tile contain recycled material and showing percent of such material in accordance with the requirements indicated.

4. Shop Drawings and Calculations: Complete Shop Drawings showing location and detail of installation, and design calculations.

a. Shop Drawings and Calculations shall be prepared, approved, and stamped by a professional civil engineer licensed per local engineering licensing laws.

b. Shop Drawings shall be drawn to sufficient scale and shall include pattern of acoustical tile, cut tile, suspension system, dimensions, details, connections, accessories, and trim of acoustical ceiling tile layout for all areas.

c. Shop Drawings shall include material descriptions, finish, color, details of construction, installation, and accessories.

1) Indicate method of anchoring and fastening.

2) Indicate necessary connections to WORK of other trades.

3) Indicate locations of light fixtures, ceiling diffusers, grilles, sprinkler heads, smoke/fire detectors and alarms, and etc.

4) Indicate where different tile types will be installed.

5) Indicate splayed and counter-splayed suspension system hanger wires.

5. Samples: The CONTRACTOR shall submit 2 samples of each of the following. Unless otherwise indicated, samples shall be full size and shall show gauges, configuration, construction, finish and color proposed for the various components. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by the ENGINEER. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the CONTRACTOR from compliance with the Contract Documents.

a. 6-inch (152 mm) by 6-inch (152 mm) acoustical tile sample for each type of tile proposed.

b. 8-inch (203 mm) long suspension system sample.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Suspended acoustical tile, suspension system, and accessories shall be provided by a single Manufacturer.

B. Manufacturer's Qualifications:

1. A minimum of 5 similar successful projects over the most recent 10 years, employing similar products, materials, applications, and performance requirements.

C. Installer Qualifications:

1. A minimum of 5 years' experience in the successful completion of at least 5 projects of similar size and scope, employing similar products, materials, applications, and performance requirements.

1.5 SPECIAL WARRANTY PROVISIONS

A. Furnish Manufacturer's 10 year written warranty to cover defects in materials, products, and manufacturing workmanship. The term of the warranty shall begin on the date of Substantial Completion.

1. Warranty shall contain an agreement to repair or replace suspended acoustical tile systems that fail within the warranty period. Failures include, but are not limited to, sagging and warping of panels; rusting and Manufacturers defects of grid system.

1.6 EXTRA MATERIALS

A. Provide 10 full size units, and enough field cut tile to fill one case, for each type of tile being provided for the WORK for future maintenance and replacement. Provide extra materials separately packaged, identified, and left with the OWNER.

B. Extra materials shall be provided from the same production run as the materials installed.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Structural Requirements:

1. Suspended Acoustical Tile, including related assemblies, components, and attachment details, shall comply with the CODE and shall be designed and installed for resistance to the structural design criteria indicated on the Drawings in accordance with the CODE. Where a conflict occurs between the requirements of this Section and the CODE, the more stringent shall apply.

2. Suspended acoustical tile ceiling system shall be engineered by the Manufacturer to carry the applied dead and live loads and shall have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories indicated with a deflection of less than 1/360 of the span, and shall be level to within 1/8-inch (3.2mm) in 12-feet (3.7 m). The ceiling system shall conform to ASTM C 635 (heavy duty classification) with a minimum load carrying capacity of the main runner of 16 lb/linear foot (16 L/linear meter) of span of 4-feet (1.2 m).

3. CONTRACTOR shall provide additional non-standard bracing, reinforcements, anchors, and heavier gauge materials if required to conform to the structural design criteria indicated and to other performance requirements herein.

B. Design Requirements: System Manufacturer shall furnish the systems herein, including necessary modifications to meet the indicated requirements and to maintain visual design concepts as approved by the ENGINEER.

2.2 ACCEPTABLE MANUFACTURERS

A. Subject to the requirements herein, provide products from the Manufacturer listed below, or equal:

1. Armstrong World Industries, Inc.

B. Suspended Acoustical Tile – Type A:

1. Wet-formed, mineral fiber tile with DuraBrite acoustically transparent membrane, **Ultima Beveled Tegular (1911).**

2. 24-inches (61 cm) by 24-inches (61 cm) by 3/4-inches (16 mm), beveled tegular edge tile, fine texture, non-directional.

3. Sag-resistant formulation, **Armstrong HumiGuard Plus**, or equal.

4. Factory applied, white acrylic latex paint finish.

5. Mold/Mildew Inhibitor: Surfaces shall be treated with a paint that contains a special biocide that inhibits or retards the growth of mildew, ASTM D 3273, **Armstrong Bioblock**, or equal.

6. Performance Requirements:

ASTM C 423 (UL Label)	Noise Reduction Coefficient (NRC): 0.70
ASTM C 1414 (UL Label)	Ceiling Attenuation Class (CAC): 35
ASTM E 84; ASTM E 1264 (UL Label)	Class A; Flame Spread 25 or less; Smoke Developed 50 or less, Type IV, Form 2, Pattern E
ASTM E 1477	0.90
Recycled content	60% to 80%

C. Suspended Acoustical Tile – Type B:

1. Ceramic and mineral fiber composite tile, Fine Fissured Ceramaguard – Perforated (607).

2. 24-inches (61 cm) by 24-inches (61 cm) by 5/8-inches (16 mm), square edge, medium texture.

3. Sag-resistant formulation, **Armstrong HumiGuard Max**, or equal.

4. Scrubbable, factory applied, white vinyl plastic paint finish.

5. Mold/Mildew Inhibitor: Surfaces shall be treated with a paint that contains a special biocide that inhibits or retards the growth of mildew, ASTM D 3273, **Armstrong Bioblock**, or equal.

6. Performance Requirements:

ASTM C 423 (UL Label)	Noise Reduction Coefficient (NRC): 0.55
ASTM C 1414 (UL Label)	Ceiling Attenuation Class (CAC): 38

ASTM E 84; ASTM E 1264 (UL Label)	Class A; Flame Spread 25 or less; Smoke Developed 50 or less, Type XX, Pattern C-E
ASTM E 1477	0.82
Recycled content	38%

2.3 SUSPENSION SYSTEM – EXPOSED GRID

A. Description:

1. Hot dipped galvanized steel main tees, cross tees, and wall moldings, **Prelude XL Exposed Tee.**

   a. All steel roll formed parts shall be chemically cleaned, electro-galvanized in accordance with ASTM C 635 and bonderized to resist corrosion and shall form a chemical affinity for paint.

   b. Steel stamped parts shall be chemically cleaned, electro-galvanized, and treated with a chromate conversion coating.

2. Exposed surfaces shall have factory applied, low sheen, satin finish, white baked polyester paint.

3. Main beams and cross tees shall be double web steel construction with a 15/16-inch (24 mm) flange surface with rotary stitching and peak form design.

4. All components shall conform to the intermediate structural classification of ASTM C 635 for heavy-duty systems.

5. Suspension system shall be made of 25% recycled content

2.4 ACCESSORIES

A. Provide accessory items as required to achieve satisfactory ceiling installation and performance.

B. Wall molding shall match the suspension system in material and finish, and shall have a flange of not less than 2-inches (51 mm). Inside and outside corner caps shall be provided.

C. Hanger and diagonal bracing wires shall be minimum 12 gauge, and shall conform to ASTM A 580/A 580M, annealed type 304 stainless steel.

1. Hangers and attachment shall support a minimum 300-pound ultimate vertical load without failure of supporting material or attachment.

D. Straps shall be 1-inch (25 mm) by 3/16-inch (4.8 mm) galvanized steel conforming to ASTM A 653/A 653M, with a light commercial zinc coating or ASTM A 1008/A 1008M with an electrodeposited zinc coating conforming to ASTM B 633, Type RS.

E. Rods shall be 3/16-inch (4.8 mm) diameter threaded steel rods, zinc or cadmium coated.

F. Spacers shall be tempered spring steel and shall be fitted into wall molding to provide tension on the ceiling system.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

1. Each carton shall carry an approved independent laboratory classification for acoustical performance (NRC, CAC, and AC).

2. Identify acoustical ceiling components with appropriate markings of applicable testing and inspection organizations for fire performance characteristics.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 APPLICATION SCHEDULE

A. Unless otherwise indicated, provide Type B tile in janitor closets, toilet, locker, and shower rooms. Provide Type A elsewhere where suspended acoustical tile is indicated.

3.3 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where suspended acoustical tile will be installed for compliance with requirements for installation, taking into account tolerances, and other conditions affecting performance of installed suspended acoustical tile.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate CONTRACTOR's acceptance of the substrate, areas, and conditions.

3.4 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after installation.

B. Installation of acoustical materials shall not be made when the building is excessively cold and damp, or hot and dry. Temperature and humidity conditions closely approximating the interior conditions that will exist when the building is occupied shall be maintained before, during, and after installation.

1. All windows, glazing, doors, roofing, and other waterproofing and weatherproofing cladding systems of the building shell shall be in place and complete.

C. Areas to receive suspended acoustical tile systems shall be free from construction dust and debris prior to installation.

D. Interior finish WORK such as wallboard, tile, painting, and "wet-work" shall be complete and dry before installation. Mechanical, electrical, and other WORK above the ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

E. Protect surrounding WORK from damage that may result from operations under this Section.

3.5 LAYOUT

A. Unless otherwise indicated, suspended acoustical tile shall be laid out symmetrically about the center of the room to provide least number of cut tiles, and where cut tiles are required, to provide the largest size border units possible.

1. Main grid members shall be installed on 24-inches (61 mm) centers and along each long side of rows of light fixture suspended with hangar wire at 48-in (122 cm) on centers, maximum.

2. Cross tees shall be spaced 24-inches (61 mm) on center to form 24-inches (61 cm) by 24-inches (61 cm) module.

3. Install wall moldings with mitered corners at intersection of ceilings and at all vertical surfaces.

4. Suspended acoustical tile shall be laid in a pattern with all edges in alignment and with all faces in a plane. There shall be no noticeable variations in the finish ceiling plane.

5. Non-directional tile shall be laid so no fissure pattern direction is established.

B. Items located within the ceiling plane such as, light fixtures, air diffusers, speakers, smoke detectors, fire sprinkler heads, and other features shall be installed at the locations indicated, shall be coordinated with other trades, and shall be installed so that all installations WORK together without interference.

1. Elements belonging to any other function (i.e., light fixtures) shall not be supported from the ceiling.

3.6 BEAM SPLICES AND TEE INTERSECTIONS

A. Main beams shall be joined together by a splice clip, which draws the members tightly together with bottom flanges flush. Cross tee intersections shall be joined together by interlock methods, by positioning the ends of the cross tees snugly against the main beam and in holding

the cross tees in vertical alignment with bottom flanges flush. Main beam splices and cross tee intersections shall be capable of withstanding the loads required.

B. The main beams and cross tees which terminate at the walls shall be attached to a perimeter wall molding, which shall be continuous along at least 2 intersecting walls, with spring steel clips. Wall molding shall be securely attached to the walls at a minimum of 16-inch (41 cm) intervals.

3.7 HORIZONTAL RESTRAINT

A. Suspended acoustical tile systems shall be provided with diagonal bracing wires. Horizontal restraints shall be effected by minimum 4 No. 12-gauge wires secured to the main beams within 2-inches (51 mm) of the cross tee intersection and splayed 90 degrees from each other at an angle not exceeding 45 degrees from the plane of the ceiling. These horizontal restraint points shall be placed 12-feet (3.7 m) on center in both directions with the first point within 4-feet (1.2 m) from each wall. The restraint wire attachment to the supporting structure shall be adequate for the loads imposed. Cable trays and electrical conduit shall be independently supported and braced

B. Seismic Design: Horizontal restraint system includes, but is not limited to the following; suspension system shall be attached to two adjacent walls – opposite walls shall have 3/4-inch (19 mm) clearance, ends of main beams and cross tees shall be tied together to prevent their spreading, perimeter support wires shall be provided, heavy-duty suspension system is required, ceiling areas over 1,000 square feet (305 square meters) shall have horizontal restraint wire or rigid bracing, ceiling areas over 2,000 square feet (610 square meters) shall have seismic separation joints or full height partitions, ceilings without rigid bracing shall have 2-inch (51 mm) oversized trim rings for sprinklers and other partitions, changes in ceiling plane shall have positive bracing, cable trays and electrical conduit shall be independently supported and braced. Changes in ceiling plane shall have positive bracing. Refer to the CODE for additional requirements.

3.8 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with the requirements of the CODE, with applicable references, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the ENGINEER.

1. Installation will be subject to special inspection per the CODE.

B. The system shall be installed so that the ceiling panels may be removed and replaced without damage, and so that main beams and cross tees can be removed or replaced without deforming the members or disturbing the balance of the grid system.

C. The suspended acoustical tile ceilings shall be erected level and in a continuous sequence.

D. The CONTRACTOR shall provide corrosion resistant fasteners, anchors, and shims required for a complete installation, and shall be secure, level, and true to line, allowing for required movement, including expansion and contraction.

1. Mechanical fastenings shall not be exposed in the finished WORK.

E. Suspension System:

1. Suspension system shall be installed in accordance with ASTM C 636 and as specified herein.

2. For Seismic Design Category D, E, F: Main beam and cross tee ends tied together to prevent their spreading.

3. Hangers shall be laid out for each individual room or space. Hangers shall be placed to support framing around beams, ducts, columns, grilles, and other penetrations through suspended acoustical tile system.

   a. For Seismic Design Category D, E, and F provide perimeter support wires.

4. Wherever required to bypass an object with the hanger wires, a sub-suspension system shall be installed, so that all hanger wires will be plumb.

5. Main runners and carrying channels shall be kept clear of abutting walls and partitions. At least two main runners shall be provided for each ceiling span.

6. Plumb Hangars: Hangers shall be plumb and shall not press against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, hangers shall be provided at a minimum of four hangers per fixture and located not more than 6-inches (152 mm) from each corner of each fixture.

7. Splayed Hangars: Where hangers must be splayed (sloped or slanted) around obstructions, the resulting horizontal force shall be offset by bracing, counter-splaying, or other acceptable means.

8. Wall Molding:

   a. Wall molding shall be provided where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Wall molding shall be secured not more than 3-inches (76 mm) from ends of each length and not more than 16-inches (406 mm) on centers between end fastenings.

   b. For Seismic Design Category D, E, and F, grid shall be attached to wall molding.

9. Acoustical Tile:

   a. Acoustical tile shall be installed in accordance with the approved installation instructions of the Manufacturer. Edges of acoustical units shall be in close contact with metal supports, with each other, and in true alignment.

   b. Acoustical tile shall be arranged so that units less than one-half width are minimized.

   c. Tile in exposed-grid system shall be held in place with Manufacturer's standard hold-down clips, if units weigh less than 1 psf (5 kgm) or required for fire resistance rating.

F. The CONTRACTOR shall provide separation of dissimilar materials to ensure no galvanic action occurs.

3.9 PROBLEM AREAS

A. Manufacturer's published recommendations and specifications shall be followed for installation, materials, and treatment of problem areas; provided, that the Manufacturer's published recommendations and specifications are not less than those required by AMA "Specification for Acoustical Tile and Lay-In Panel Ceiling Suspension Systems," and the CODE.

3.10 CLEANING

A. Following installation, dirty or discolored surfaces of suspended acoustical tile, suspension system, and exposed accessories shall be cleaned and left free from defects.

B. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Film and labels left in place after installation shall be the responsibility of the CONTRACTOR.

2. Residue shall not be left on any surfaces.

C. Upon completion of the installation, suspended acoustical tile and appurtenances shall be cleaned of all dirt and other foreign matter to the satisfaction of the ENGINEER.

1. Cleaning shall be performed again immediately prior to acceptance of the WORK, when directed by the ENGINEER.

2. Cleaning shall be performed in accordance with the Manufacturer's written instructions.

D. Suspended Acoustical Tile shall be protected from damage from subsequent construction operations.

E. The CONTRACTOR shall remove scratches and blemishes to the satisfaction of the ENGINEER.

F. Damaged or defective items shall be removed and replaced at the direction of the ENGINEER, at no additional cost to the ENGINEER.

G. When suspended acoustical tile WORK is completed, remove unused materials, containers, and equipment, and clean the Site of suspended acoustical tile debris.

END OF SECTION

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SECTION 09 65 00 – RESILIENT FLOORING

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide vinyl composition tile, resilient base, and appurtenant WORK, complete and in place, in accordance with the Contract Documents.

B. The CONTRACTOR shall coordinate color samples with other Sections through the submittal process.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. Americans with Disabilities Act (ADA):

ADAAG	Americans with Disabilities Accessibility Guidelines

C. American Society of Testing and Materials (ASTM):

ASTM C 1028	Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
ASTM E 84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E 648	Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
ASTM E 662	Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
ASTM F 710	Standard Practice for Preparing Concrete Floor Slabs to Receive Resilient Flooring
ASTM F 970	Standard Test Method for Static Load Limit
ASTM F 1066	Vinyl Composition Floor Tile
ASTM F 1861	Standard Specification for Resilient Wall Base
ASTM F 1869	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Sub-floor Using Anhydrous Calcium Chloride
ASTM F 2170	Standard Test Method for Determining Relative Humidity in Concrete Slabs using In Situ Probes

D. Architectural Transportation Barriers Compliance Board (ATBCB): Slip Resistance Advisory Guidelines

E. Building Code: Refer to the Drawings to determine which building code applies. The applicable building code, defined by the Drawings, is referred to herein as “the CODE”.

F. Green Seal Standards:

GS-36	Standard for Commercial Adhesives, October 19, 2000

G. National Fire Protection Agency (NFPA):

NFPA 253	Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
NFPA 258	Standard Research Test Method for Determining Smoke Generation of Solid Materials

H. Scientific Certification Systems (SCS)/Resilient Floor Covering Institute (RFCI):

SCS/RFCI	FloorScore IAQ Testing and Certification Program – California Specification 01350 compliance

I. South Coast Air Quality Management District (SCAQMD):

SCAQMD	Rule No. 1168

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Literature: Manufacturer’s specifications, technical data, installation methods, and maintenance instructions, and the following:

1. Tile Manufacturer’s standard color and pattern charts for color selection by the OWNER.
2. Base Manufacturer’s standard color charts for color selection by the OWNER.
3. Edging Manufacturer’s standard color charts for color selection by the OWNER.

C. Warranty: Submit a copy of the warranty.

D. Certifications:

1. Certification by the tile and base Manufacturer that the tile and base materials provided are suitable for, and compatible with, the required installation.

2. Certification by the tile and base Manufacturer that the products supplied are compatible with the adhesives, primers, patching and leveling compounds, fillers, and surfacers required.

3. Certification from the tile Manufacturer that the polish is suitable for, and compatible with, the tile.

4. Certification that the tile has been tested by an independent laboratory and complies with ASTM E 648/NFPA 253 and ASTM E 662/NFPA 258.

5. Certification by the tile Manufacturer that provided the products conform to ASTM F 1066, Class II, Through Pattern.

6. Certification by the base Manufacturer that the products conform to ASTM F 1861, Type TP, Group 1 (solid) or Group 2 (layered).

7. Certification by the base Manufacturer that the products conform to ASTM E 84, Class C.

8. Independent certification that the products comply with the VOC limits and VOC performance criteria indicated.

9. Certification of Manufacturer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, Manufacturer's products, and contact information of the consultant firm of record, general contractor and owner.

10. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, and contact information of the consultant firm of record, general contractor and owner.

11. Certification that the required substrate tests have been performed, and that the substrates are suitable for the installation.

E. Shop Drawings: Complete shop drawings showing location and detail of installation.

1. Tile layout, patterns, and control joint locations and details.
2. Base details, utilizing maximum base length dimensions as possible.

F. Samples: The CONTRACTOR shall submit 2 samples of each of the following. Unless otherwise indicated, samples shall be full size and shall show gauges, configuration, construction, finish and color proposed for the various components. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by the ENGINEER. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the CONTRACTOR from compliance with the Contract Documents.

1. 8-inch (203 mm) by 8-inch (203 mm) of each vinyl composition tile type, color, and pattern to be provided.

2. 8-inch (203 mm) long sample of each resilient base type, and color to be provided.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility:

1. Vinyl composition tile shall be provided by a single Manufacturer.

a. Each color, grade, finish, type, composition, and variety of tile shall be obtained from a single production run.

2. Resilient base shall be provided by a single Manufacturer.

3. Adhesives, primers, patching and leveling compounds, fillers and surfacers shall be provided by a single Manufacturer, each.

4. Polish shall be provided by a single Manufacturer.

B. Manufacturer Qualifications:

1. Tile Manufacturer shall have a minimum of 15 years of vinyl composition tile manufacturing experience.

2. A minimum of 5 similar successful projects over the most recent 10 years, employing similar products, materials, applications, and performance requirements.

3. Manufacturers without these qualifications will not be accepted.

C. Installer Qualifications:

1. A minimum of 5 years' experience in the successful completion of at least 5 projects of similar size and scope, employing similar products, materials, applications, and performance requirements.

2. Installer shall be trained, authorized, and approved by the Manufacturer to install the Manufacturer's product.

3. Installers without these qualifications will not be accepted.

D. Sample Mock-Up:

1. Prior to installation, erect sample mock-up of the tile using materials and details required for final WORK. The panel shall be approximately 8-feet (2.3 m) by 8-feet (2.4 m). The sample mock-up shall show the workmanship, joints, colors, layout and pattern of the tile.

2. The sample panel shall be erected in a location as designated by the ENGINEER.

a. The sample panel may be constructed as part of the WORK, but must be constructed to the satisfaction of both the ENGINEER and the OWNER prior to acceptance of the panel, and must be accepted prior to proceeding with the remainder of the vinyl composition tile and resilient base WORK.

b. If the sample mock-up is provided separate from the WORK, retain mock-up during construction as a standard for judging completed WORK. Do not alter, move, or destroy mock-up until WORK is completed.

3. Obtain ENGINEER's and OWNER's acceptance of qualities of mock-up before installation. Modify and/or reconstruct sample mock-up at the direction of the ENGINEER until acceptance.

4. Acceptance of sample mock-up shall not relieve the CONTRACTOR from compliance with the Contract Documents.

1.5 SPECIAL WARRANTY PROVISIONS

A. Furnish Manufacturer's 5 year written warranty to cover defects in materials, products, and manufacturing workmanship.

1. The term of the warranty shall begin on the date of Substantial Completion.

1.6 EXTRA MATERIALS

A. A 5 percent overage of calculated coverage for each type of tile and six 4-foot (1.2 m) lengths of resilient base being furnished for the WORK shall be provided for future maintenance and replacement, separately packaged, identified, and left with the OWNER.

B. Extra materials shall be provided from the same production run as the materials installed.

PART 2 PRODUCTS

2.1 GENERAL

2.2 VINYL COMPOSITION TILE

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide products from one of the Manufacturer's listed below, or equal

a. Armstrong; Imperial Texture, Standard Excelon.
b. Mannington; Designer Essentials.

B. Description:

1. Tile shall be a composed of polyvinyl chloride resin binder, plasticizers, fillers, and pigments with colors and texture dispersed uniformly through its thickness.

2. Tile shall have an overall thickness of 0.125-inches (3.2 mm) nominal, and shall be 12-inch (305 mm) by 12-inch (305 mm) nominal size.

3. Coefficient of Friction (COF) ASTM C 1028 shall be greater than or equal 0.60, per ADAAG and ATBCB.

4. Tile shall be SCS/RFCI FloorScore Certified for low VOC's.

5. Performance Standards:

ASTM E 648/NFPA 253	Greater than or equal to 0.45 watts/sq cm, Passes Class I
ASTM E 662/NFPA 258	Less than 450-passes
ASTM F 970	Static Load Limit, 125 psi
ASTM F 1066	Class II, Through pattern, asbestos-free

2.3 RESILIENT BASE

A. Manufacturer and Product, or Equal

1. Subject to the requirements indicated, provide products from one of the Manufacturer's listed below, or equal

a. Armstrong; Color-Integrated Wall Base.
b. Johnsonite; Traditional Rubber Wall Base.
c. Roppe; 700 Series Wall Base.

B. Description:

1. Base shall be Type TP thermoplastic extruded resilient, smooth and free from imperfections.

2. Unless otherwise indicated, base shall be 1/8-inch (3.2 mm) thick by 4-inches (102 mm) high, matte finish.

3. Profile: Style B (Cove), unless otherwise indicated.

4. Performance Standards:

ASTM E 84	Flame Spread 150, Class C
ASTM E 648/NFPA 253	Greater than or equal to 0.45 watts/sq cm, Passes Class I
ASTM E 662/NFPA 258	Less than 450 – passes
ASTM F 1861	Type TP, Group 1 or Group 2

5. Provide in rolls to be cut in lengths required.

6. Provide standard inside and outside preformed corners with base system.

2.4 EDGING

A. Edging shall comply with the performance standards for resilient base as indicated above.

B. Edging shall be compatible with the tile and shall be 1-inch (25 mm) minimum width homogeneous resilient.

C. Edging shall be installed at the juncture between vinyl composition tile and carpeting and/or between vinyl composition tile and exposed concrete floors.

2.5 COLORS AND PATTERNS

A. Color of tile, base, and edging shall be selected and approved by the OWNER from the Manufacturer's full color range.

1. Tentative color selection:

a. Tile – Provide for three (3) different tile colors to be selected.
b. Base – To Be Selected.
c. Edging – To Be Selected.

2. The OWNER reserves the option of changing this tentative color selection during the submittal process.

3. Final colors, pattern, and appearance shall be selected and approved by the OWNER prior to installation.

2.6 ADHESIVES, SEALANTS, AND SEALANT PRIMERS

A. Subject to the requirements herein, adhesives, sealants, and sealant primers shall be as recommended by the tile and base Manufacturer, respectively, as applicable to the project conditions.

B. Adhesives, sealants, and sealant primers shall be low VOC per SCAQMD Rule No. 1168.

C. Adhesives, sealants, and sealant primers shall be resistant to alkalis and moisture and shall be capable of securely holding the materials in place, sealing and bonding the joints.

D. Aerosol adhesives shall comply with GS-36 VOC limits.

2.7 PATCHING AND LEVELING COMPOUNDS, FILLERS AND SURFACERS

A. Floor surface preparation materials shall be as recommended by the Manufacturer as applicable to the project conditions.

B. Floor surface preparation materials shall be low VOC per SCAQMD Rule No. 1168.

2.8 POLISH

A. Floor polish shall be suitable for, and compatible with, the tile, as recommended by the tile Manufacturer.

B. Floor polish shall be low VOC per SCAQMD Rule No. 1168.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

2. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units shall be rejected.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where tile, base, and edging will be installed for compliance with requirements for installation, taking into account tolerances, and other conditions affecting performance of installed tile, base, and edging.

a. Substrates for setting tile and base shall be firm, sound, dimensionally stable, dry, clean, free from oil, waxy films, curing compounds, and other foreign substances; and shall be within flatness tolerances required by the Manufacturer, or by the referenced standards, whichever is more stringent shall apply.

b. Perform calcium chloride test in accordance with ASTM F 1869. The maximum acceptable moisture vapor emission shall not exceed 3 pounds per 1,000 square feet (305 square meters) per 24 hours. Follow adhesive Manufacturer's instructions to achieve acceptable moisture vapor emission levels for proper installation.

c. Perform substrate humidity test in accordance with ASTM F 2170. Comply with tile Manufacturer's written instructions to achieve acceptable relative humidity levels in the concrete slab prior to applying flooring materials. In no case should the humidity levels in the slab be greater than 75 percent prior to applying materials.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate CONTRACTOR's acceptance of the substrate, areas, and conditions.

3.3 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after application.

B. Installation shall not be made when the building is excessively cold and damp, or hot and dry. Temperature and humidity conditions closely approximating the interior conditions that will exist when the building is occupied shall be maintained before, during, and after installation.

1. All windows, glazing, doors, roofing, and other waterproofing and weatherproofing cladding systems of the building shell shall be in place and complete.

C. Do not apply flooring materials until the WORK of other trades, including painting, has been completed.

1. Exceptions include: furniture, equipment, and moveable partitions.

D. Allow tile and base to reach room temperature or minimum temperature recommended by Manufacturer before beginning installation.

E. Protect adhesives from freezing. Follow Manufacturer's recommendations for minimum temperatures to which adhesives are exposed.

F. Protect surrounding WORK from damage that may result from operations under this Section.

3.4 SURFACE PREPARATION

A. Surface preparation shall be in compliance with ASTM F 710, and with the Manufacturer's written instructions.

B. Coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone, that are incompatible with flooring materials shall be removed by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

C. Protrusions, bumps, ridges, and loose substrate surface materials shall be removed by sanding or grinding.

D. Trowelable leveling and patching compounds shall be used per tile Manufacturer's written instructions to fill cracks, holes, and depressions.

E. Immediately before application of tile and base materials, scrape surfaces to be covered free from foreign materials and brush clean.

F. Substrate shall be swept to remove all loose materials prior to beginning tile and base installation.

3.5 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with the requirements of the CODE, with ADAAG, with applicable references, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply as directed by the ENGINEER.

B. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

C. Vinyl Composition Tile Installation:

1. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged if so numbered. Broken, cracked, chipped, or deformed tiles will not be accepted.

2. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of room are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile adjacent to room perimeters as applicable. Lay tile in grid pattern square to room axis. Fit tile tightly to walls and doorframes getting edge of tile to back of racked joint in masonry walls.

3. Install tile wall-to-wall before the installation of furniture, equipment, and moveable partitions.

4. Extend tile into toe spaces, door recesses, closets, and similar openings as indicated or as required.

5. Scribe, cut, and fit tile neatly around permanent fixtures, including but not limited to; columns, walls, partitions, pipes, outlets, built-in furniture and casework.

D. Resilient Base Installation:

1. Apply adhesive in a thin but thorough covering coat in accordance with the Manufacturer's instructions.

2. Cut materials to proper size and press firmly into adhesive over full contact area. Fit closely at joints and abutting surfaces. At doors, stop base at outside edge of reveal in doorframe and cut at 45 degrees to corner of masonry adjoining frame.

3. Base shall be applied in long lengths with joints at corners only and upon completion the bottom edge shall be in firm contact with the finished floor.

4. For sealing joints between top of the wall base and irregular wall surfaces, such as masonry or similar, provide plastic filler applied according to the Manufacturer's written instructions.

E. Upon completion, tile, base, and appurtenances shall form a smooth, firm flat plane free from waves, buckles, cracks, breaks, bumps, and projecting edges.

3.6 CLEANING, FINISHING, AND PROTECTION

A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Film and labels left in place after installation shall be the responsibility of the CONTRACTOR.

2. Residue shall not be left on any surfaces

B. Upon completion of the installation, tile, base and appurtenances shall be cleaned of dirt, adhesives, and other foreign matter to the satisfaction of the ENGINEER.

1. Cleaning shall be performed again immediately prior to acceptance of the WORK, when directed by the ENGINEER.

2. Cleaning shall be performed in accordance with the Manufacturer's written instructions.

C. Apply polish in accordance with Manufacturer's written instructions.

D. Tile and base shall be protected from damage from subsequent construction operations.

1. Protect the WORK at all times and arrange for the closing off of traffic and other WORK when this is necessary to avoid damage to finished surfaces.

E. The CONTRACTOR shall remove scratches and blemishes to the satisfaction of the ENGINEER.

F. Damaged or defective items shall be removed and replaced as determined by ENGINEER.

G. When tile and base WORK is completed, remove unused materials, containers, and equipment, and clean the Site of tile and base debris.

END OF SECTION

SECTION 09 68 00 – CARPETING

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide carpeting and rubber base appurtenant WORK, complete and in place, in accordance with the Contract Documents.

B. The CONTRACTOR shall coordinate color samples with other Sections through the submittal process.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. American Association of Textile Chemists and Colorists (AATCC):

AATCC 16 Test Method of Colorfastness to Light

AATCC 107 Test Method for Colorfastness to Water

AATCC 129 Test Method for Colorfastness to Ozone in the Atmosphere under High Humidity

AATCC 134 Test Method for Electrostatic Propensity of Carpets

AATCC 165 (93) Test Method for Colorfastness to Crocking: Carpets – AATCC Crock meter Method

AATCC 175 (98) Test Method for Stain Resistance: Pile Floor Coverings

AATCC 189 Test Method for Fluorine Content of Carpet Fibers

AATCC 164 Test Method for Colorfastness to Oxides of Nitrogen in the atmosphere under High Humidities

C. Americans with Disabilities Act (ADA):

ADAAG Americans with Disabilities Accessibility Guidelines

D. American Society of Testing and Materials (ASTM):

ASTM D 418 (12) Methods for Testing Pile Yarn Floor Covering Construction (Finished Pile thickness only)

ASTM D 1335 Standard Test Method for tuft Bind of Pile Yarn Floor Covering

ASTM D 3574 Standard Test Methods for Flexible Cellular Materials – Slab, Bonded, and Molded Urethane Foams

ASTM D 3676 Standard Specification for Rubber Cellular Cushion Used for Carpet or Rug Underlay (covers thickness, Compression Resistance, Volume, Density, Compression Set, and Accelerated Aging)

ASTM D 3936 Standard Test Method for Resistance to Delamination of the Secondary Backing of Pile Yarn Floor Covering

ASTM D 5793 Standard Test Method for Binding Sites Per Unity Length or Width of Pile Yarn Floor Coverings

ASTM D 5823 Standard Test Method for Tuft Height of Pile Floor Coverings

ASTM D 5848 Standard Test Method for Mass per Unity of Pile Yarn for Floor Covering

ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E 648 Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

ASTM E 662 Test Method for Specific Optical Density of Smoke Generated by Solid Materials

ASTM F 1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Sub-floor Using Anhydrous Calcium Chloride

ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Slabs using In Situ Probes

E. Building CODE: Refer to the Drawings to determine which building code applies within a given jurisdiction. The applicable building code, defined by the Drawings, is referred to herein as “the CODE”.

F. Carpet and Rug Institute (CRI): CRI Indoor Air Quality Testing and Labeling Program.

G. International Standards Organization (ISO): ISO 2551, Test Method for Dimensional Stability (Aachen test).

H. National Fire Protection Agency (NFPA):

NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

NFPA 258 Standard Research Test Method for Determining Smoke Generation of Solid Materials

I. South Coast Air Quality Management District (SCAQMD):

SCAQMD Rule No. 1168

J. Supplemental Testing Procedures: PT-155-Rev. 86, Loop Pile Run Resistance test

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Literature: Manufacturer's specifications, technical data, installation methods, and maintenance instructions, and the following:

1. Carpet Manufacturer's standard color and pattern charts for color selection by the OWNER.

2. Base Manufacturer's standard color charts for color selection by the OWNER.

3. Edging Manufacturer's standard color charts for color selection by the OWNER.

C. Warranty: Submit a copy of the warranty.

D. Certifications:

1. Certification by the carpet and base Manufacturer that the carpet and base materials provided are suitable for, and compatible with, the required installation.

2. Certification by the carpet and base Manufacturer that the products supplied are compatible with the curing compounds, adhesives, primers, patching and leveling compounds, fillers, and surfacers required.

3. Certification that the carpet has been tested by an independent laboratory and complies with ASTM E 648/NFPA 253 and ASTM E 662/NFPA 258.

4. Certification by the base Manufacturer that the products conform to ASTM E 84, Class C.

5. Certification of recycled content by third party certification (Scientific Certification Systems) as required for select materials herein.

6. Independent certification that the products comply with the VOC limits and VOC performance criteria indicated.

7. Certification of compliance with the requirements of paragraph 2.1.

8. Certification of Manufacturer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, Manufacturer's products, and contact information of the consultant firm of record, general contractor and owner.

9. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, and contact information of the consultant firm of record, general contractor and owner.

10. Certification that the required substrate tests have been performed, and that the substrates are suitable for the installation.

E. Shop Drawings: Complete shop drawings showing location and detail of installation. Include carpet layout, pattern direction, and seam diagram, installation accessories, and locations of installation.

1. Show location of different patterns or styles of carpet.
2. Utilize maximum carpet width and rubber base length dimensions as possible.

F. Samples: The CONTRACTOR shall submit 2 samples of each of the following. Unless otherwise indicated, samples shall be full size and shall show configuration, construction, finish and color proposed for the various components. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by the ENGINEER. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the CONTRACTOR from compliance with the Contract Documents.

1. 8-inches (203 mm) by 8-inches (203 mm) sample of each carpet type, color, and pattern to be provided.

2. 8-inch (203 mm) long sample of each rubber base type, and color to be provided.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility:

1. Carpet shall be provided by a single Manufacturer.

a. Each color, grade, finish, type, composition, and variety of carpet shall be obtained from a single production run.

2. Rubber base shall be provided from a single Manufacturer.

3. Adhesives, primers, patching and leveling compounds, fillers and surfacers shall be provided by a single Manufacturer, each.

B. Manufacturer Qualifications:

1. Carpet Manufacturer shall have a minimum of 15 years of commercial carpet manufacturing experience.

2. A minimum of 5 similar successful projects over the most recent 10 years, employing similar products, materials, applications, and performance requirements.

3. Manufacturers without these qualifications will not be accepted.

C. Installer Qualifications:

1. A minimum of 5 years experience in the successful completion of at least 5 projects of similar size and scope, employing similar products, materials, applications, and performance requirements.

2. Installer shall be trained and approved by the Manufacturer to install the Manufacturer’s product.

3. Installers without these qualifications will not be accepted.

4. Installer shall provide the necessary licenses, performance bonds, and insurance certificates in compliance with local, state, and federal laws, ordinances, or codes prior to the start of installation.

5. Installer shall be mill certified for installing carpet products

1.5 SPECIAL WARRANTY PROVISIONS

A. Furnish Manufacturer’s limited lifetime written warranty to cover defects in materials, products, and manufacturing workmanship.

1. Fiber shall have lifetime static warranty.

2. Provide full spectrum of Manufacturer's lifetime warranties to cover wear, tuff bind, static, edge ravel, zippering, piling and fuzzing, delamination, impervious to liquids, and dimensional stability.

3. Provide supplemental fiber warranty for 10-year colorfastness to light and 5-year colorfastness to atmospheric contaminants.

B. The CONTRACTOR shall furnish separate, but concurrently running, 5 year written warranty to include coverage for carpet installer's warranty against defects in installation.

C. All warranty items shall be non-prorated for the entire warranty period.

D. The term of the warranty(ies) shall begin on the date of Substantial Completion.

1.6 EXTRA MATERIALS

A. A 5 percent overage of calculated yardage for each type of carpet and six 4-foot (1.2 m) lengths of rubber base being furnished for the WORK shall be provided for future maintenance and replacement, separately packaged, identified, and left with the OWNER.

B. Extra materials shall be provided from the same production run as the materials installed.

PART 2 PRODUCTS

2.1 GENERAL

A. Carpet shall be 100 percent recyclable.

B. Carpet shall contain 15 percent post consumer recycled content based on total product weight. Every square yard (meter) shall contain the recycled content materials (direct insertion method).

C. Indoor Air Quality (IAQ) Requirements:

1. Carpet products shall be CRI Green-Label Certified.

2. Carpet products shall be low VOC such that no odor shall be detected during installation.

3. Building Flush Out: Carpet installation shall not require building flush out period to reduce VOC.

2.2 CARPET

A. Manufacturer and Product, or Equal:

1. Subject to the requirements herein, provide products from the Manufacturer listed below, or equal.

a. Mohawk Commercial Carpet Group; Lago Collection II Book 1, Siena MC022, Broadloom type.

B. Description:

1. All yarn and other carpet materials shall be Manufacturer's first quality. Carpet shall have no secondary backing post applied in manufacturing process that could eventually delaminate through installed application. Carpet shall have multi-layer tufting foundation and shall be imperious to moisture.

2. Carpet shall be constructed as follows:

a. Construction: Tufted/Ultra Performance System RE.
b. Surface Appearance: Textured Patterned Loop.
c. Fiber Type: DuPont Antron Lumena Nylon.
d. Pitch/Gauge: 1/12.
e. Pile Weight: 28.0-oz/sq. yd.
f. Pile Thickness 0.141-inches (3.6 mm).
g. Stitches/Rows per Inch: 11.0.
h. Dye Method: Solution Dyed.
i. Protective Treatment: DuraTech Soil Release Technology.
j. Density: 7,149.
k. Weight Density: 200,172.
l. Backing Foundation: Composite Foundation.
m. Pattern Repeat: 18-inches (457 mm) (W) × 20.4-inches (581.2 mm) (L).
n. IAQ Green Label: 40904952.
o. Environmental Standard: No 4 PCH; no PVC.

3. Carpet Performance Requirements shall be as follows:

a. ASTM E 648/NFPA 253: greater than 0.45 watts/sq. cm: Class 1.
b. ASTM E 662: 450 Flaming Mode – Maximum.
c. Static Generation AATCC 134: 3.5 KV – Maximum.
d. Lightfastness AATCC 16E: Minimum 4.0 at 40 hours.
e. Crocking AATCC 165: 4.0 – Wet/Dry.

f. Cold Water Bleed AATCC 107 3.0 – Minimum.
g. Ozone Fade AATCC 129: 3.0 – Minimum.
h. Soil Protection AATCC 189: 500 PPM Minimum.
i. CRI Green Label Air Quality Certification: Pass.
j. Stain Protection AATCC 175: Equal to or greater than 8.0 on Red 40 stain test.
k. CRI Appearance Retention Rating: 3.0 minimum – Heavy Traffic.

2.3 RUBBER BASE

A. Manufacturer and Product, Or Equal:

1. Subject to the requirements indicated, provide products from one of the Manufacturer's listed below, or equal

a. Armstrong; Color-Integrated Wall Base.
b. Johnsonite; Traditional Rubber Wall Base.
c. Roppe; 700 Series Wall Base.

B. Description:

1. Base shall be Type TP thermoplastic extruded rubber, smooth and free from imperfections.

2. Unless otherwise indicated, base shall be 1/8-inch (3.2 mm) thick by 4-inches (102 mm) high, matte finish.

3. Profile: Style A (Straight), unless otherwise indicated.

4. Performance Standards:

ASTM E 84	Flame Spread 150, Class C
ASTM E 648/NFPA 253	Greater than or equal to 0.45 watts/sq cm, Passes Class I
ASTM E 662/NFPA 258	Less than 450 - passes
ASTM F 1861	Type TP, Group 1 or Group 2

5. Provide in rolls to be cut in lengths required.

6. Provide standard inside and outside preformed corners with base system.

2.4 EDGING

A. Edging shall comply with the performance standards for rubber base as indicated above.

B. Edging shall be compatible with the carpet and shall be 1-inch (25 mm) minimum width homogeneous rubber.

C. Edging shall be installed at the juncture between carpeting and vinyl composition tile and/or between carpet and exposed concrete floors.

2.5 COLORS AND PATTERNS

A. Color of carpet, base, and edging shall be selected and approved by the OWNER from the Manufacturer's full color range.

1. Tentative color selection:

a. Carpet – 589 Deep Pool.
b. Base – To Be Selected.
c. Edging – To Be Selected.

2. The OWNER reserves the option of changing this tentative color selection during the submittal process.

B. Final colors, pattern and appearance shall be selected and approved by the OWNER prior to installation.

2.6 ADHESIVES AND PRIMERS

A. Subject to the requirements herein, adhesives and primers shall be as recommended by the carpet and base Manufacturer, respectively, as applicable to the project conditions.

B. Multipurpose adhesive shall be Low VOC **NuBroadlok,** or equal premium multipurpose adhesive or **NuSprayLok,** or equal adhesive, as recommended by carpet Manufacturer for direct glue down of carpeting.

C. Adhesives and primers shall be resistant to alkalis and moisture and shall be capable of securely holding the materials in place, sealing and bonding the joints.

D. Adhesives and primers shall comply with CRI Green Label Certification Program.

E. Adhesives and primers shall be low VOC per SCAQMD Rule No. 1168.

2.7 PATCHING AND LEVELING COMPOUNDS, FILLERS AND SURFACERS

A. Subject to the requirements herein, floor surface preparation materials shall be as recommended by the Manufacturer as applicable to the project conditions.

B. Leveling compound shall be latex type as recommended by carpet Manufacturer; compatible with carpet adhesive and curling/sealing compound used on concrete.

C. Floor surface preparation materials shall be low VOC per SCAQMD Rule No. 1168.

2.8 MISCELLANEOUS

A. Subject to the requirements herein, miscellaneous materials, cushion, and other carpet products shall be provided in compliance with the requirements herein and as recommended by carpet Manufacturer; as required to complete installation.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

2. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units shall be rejected.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where carpet, base, and edging will be installed for compliance with requirements for installation, taking into account tolerances, and other conditions affecting performance of installed carpet, base, and edging.

a. Substrates for setting carpet and base shall be firm, sound, dimensionally stable, dry, clean, free from oil, waxy films, curing compounds, and other foreign substances; and shall be within flatness tolerances required by the Manufacturer, or by the referenced standards, whichever is more stringent shall apply.

b. Perform calcium chloride test in accordance with ASTM F 1869. The maximum acceptable moisture vapor emission shall not exceed 3 pounds per 1,000 square feet (305 square meters) per 24 hours. Follow adhesive Manufacturer's instructions to achieve acceptable moisture vapor emission levels for proper installation.

c. Perform substrate humidity test in accordance with ASTM F 2170. Comply with tile Manufacturer's written instructions to achieve acceptable relative humidity levels in the concrete slab prior to applying flooring materials. In no case should the humidity levels in the slab be greater than 75 percent prior to applying materials.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate CONTRACTOR's acceptance of the substrate, areas, and conditions.

3.3 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after application.

B. Installation shall not be made when the building is excessively cold and damp, or hot and dry. Temperature and humidity conditions closely approximating the interior conditions that will exist when the building is occupied shall be maintained before, during, and after installation.

1. All windows, glazing, doors, roofing, and other waterproofing and weatherproofing cladding systems of the building shell shall be in place and complete.

C. Do not apply flooring materials until the WORK of other trades, including painting, has been completed.

1. Exceptions include: furniture, equipment, and moveable partitions.

D. Allow carpet to reach room temperature or minimum temperature recommended by Manufacturer before beginning installation.

E. Protect adhesives from freezing. Follow Manufacturer's recommendations for minimum temperatures to which adhesives are exposed.

F. Protect surrounding WORK from damage that may result from operations under this Section.

3.4 SURFACE PREPARATION

A. Coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials shall be removed by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

B. Protrusions, bumps, ridges, and loose substrate surface materials shall be removed by sanding or grinding.

C. Trowelable leveling and patching compounds shall be used per tile Manufacturer's written instructions to fill cracks, holes, and depressions.

D. Immediately before application of carpet and base materials, scrape surfaces to be covered free from foreign materials and brush clean.

E. Substrate shall be swept to remove all loose materials prior to beginning carpet and base installation.

3.5 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with the requirements of the CODE, with ADAAG applicable references, and with Manufacturer's

written instructions. Where a conflict occurs among these requirements, the more stringent shall apply as directed by the ENGINEER.

B. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

C. Rubber Base Installation:

1. Apply primer, if required, and adhesive in a thin but thorough covering coat in accordance with the Manufacturer's instructions.

2. Cut materials to proper size and press firmly into adhesive over full contact area. Fit closely at joints and abutting surfaces. At doors, stop base at outside edge of reveal in doorframe and cut at 45 degrees to corner of masonry adjoining frame.

3. Base shall be applied in long lengths with joints at corners only and upon completion the bottom edge shall be in firm contact with the subfloor, with the juncture hidden by the carpet.

D. Carpet Installation:

1. Rubber base shall be installed before carpet installation can proceed. Coordinate the WORK accordingly.

2. All WORK shall be installed neatly and carefully by experienced mechanics in accordance with the Manufacturer's specific recommendations and the approved shop drawings. The finished WORK shall be completed, secure, and of best possible appearance. Cooperate with all trades in carrying the WORK to prompt and successful completion and coordinate the installation with the WORK under related Sections as necessary.

3. Obtain exact dimensions and grades necessary for fitting the WORK to structural conditions and shall be entirely responsible for the accurate execution of all parts of the WORK. WORK shall be set accurately to established lines and elevations and securely fixed in place with attachments suitable to the building construction.

    a. Carpeting shall be stretched as recommended by the Manufacturer, and shall be cut evenly along walls and fit evenly around all projections into trim strips. Carpeting shall fit closely and evenly to and through thresholds, and where carpet joins together at doorways.

4. Carpet shall be installed directly over concrete floors continuously through all areas scheduled. Width between seams shall not be less than shown on approved shop drawings. Provide edge guards and install as required and approved.

5. Fit Sections of carpet into each space prior to application of adhesive. Trim edges and butt cuts with seaming cement.

6. All carpet shall run in the same direction. Carpet in all spaces shall be so installed that the minimum number of carpet Sections are used.

a. Carpet shall be provided in sizes to eliminate seams as much as possible. Fill strips shall not be less than 36-inches (914 mm) in width and at least 36-inches (914 mm) in length and made at least 4-feet (1.2 m) from doors. Cross seams shall be held to an absolute minimum. Seams and cross seams shall be selvage edge trimmed shall be bonded against unraveling with seam adhesive. Seams shall be ironed flush at tight so joint line is not noticeable. Fastenings shall be concealed.

7. Apply adhesive uniformly to substrate in accordance with Manufacturer's instructions. Butt carpet edges tightly together to form seams without gaps. Apply edge guards where required. Roll entire carpet area lightly to eliminate air pockets and ensure uniform bond.

a. Remove all adhesive promptly from face of carpet by method that will not damage carpet face, as recommended in writing by the carpet Manufacturer.

E. Upon completion, carpet, base, and appurtenances shall form a smooth, firm flat plane free from tacks, scraps, ripples, waves, buckles, scallops, puckers, bumps, and projecting edges.

3.6 CLEANING, FINISHING, AND PROTECTION

A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Film and labels left in place after installation shall be the responsibility of the CONTRACTOR.

2. Residue shall not be left on any surfaces

B. Upon completion of the installation, carpet, base, and appurtenances shall be cleaned of dirt, adhesives, and other foreign matter to the satisfaction of the ENGINEER.

1. Cleaning shall be performed again immediately prior to acceptance of the WORK, when directed by the ENGINEER.

2. Cleaning shall be performed in accordance with the Manufacturer’s written instructions.

3. Vacuum-clean carpeted areas as recommended by the Manufacturer. Trim loose threads.

C. Carpet and base shall be protected from damage from subsequent construction operations.

1. Protect the WORK at all times and arrange for the closing off of traffic and other WORK when this is necessary to avoid damage to finished surfaces.

D. The CONTRACTOR shall remove scratches and blemishes to the satisfaction of the ENGINEER.

E. Damaged or defective items shall be removed and replaced at the direction of the ENGINEER.

F. When carpet and base WORK is completed, remove unused materials, containers, and equipment, and clean the Site of carpet and base debris.

END OF SECTION

SECTION 09 90 00 - PAINTING AND COATING

PART 1 GENERAL

1.1 SUMMARY

A. Work under this Section includes the protective coating of specified surfaces including all surface preparation, pretreatment, coating application, touch-up of factory coated surfaces, protection of surfaces not to be coated, cleanup, and appurtenant work, all in accordance with the requirements of the Contract Documents.

B. This specification is applicable to process piping as shown on the Pipe Schedule on the Drawings.

C. Related Requirements:

1. The Coating System Schedules summarize the surfaces to be coated, the required surface preparation, and the coating systems to be applied. Coating notes in the Drawings are used to show exceptions to the schedules, to show or extend the limits of coating systems, or to clarify or show details for application of the coating systems.

2. Shop coatings and/or factory finishes on fabricated or manufactured equipment may be specified in other divisions. Some items with factory finishes, or corrosion resistant finishes may be scheduled or directed to be painted by the Engineer to unify a wall finish or color scheme, at the Engineer's discretion.

3. Exclusions - Do not coat the following surfaces unless specified or directed elsewhere: Stainless steel, aluminum, copper, brass, bronze, and other corrosion-resistant material (except for valve bodies and piping); Electrical switchgear and motor control centers having factory finish; Fencing; Multiple coated factory finished baked enamel or porcelain products; Concealed areas such as ducts, piping, conduits, and items specified elsewhere for special linings and coatings.

4. Damaged Factory Finish - If directed by the Engineer, refinish the entire exposed surfaces of equipment chipped, scratched, or otherwise damaged in shipment or installation.

5. Provide NSF approved coating for equipment in contact with potable water.

1.2 REFERENCE STANDARDS

A. Association for Materials Protection and Performance (Formally NACE International and SSPC)

1. SP0188 – Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

2. SP1 – Solvent Cleaning

3. SP2 – Hand tool Cleaning

4. SP3 – Power Tool Cleaning

5. SP5 – White Metal Blast Cleaning

6. SP6 – Commercial Blast Cleaning

7. SP10 – Near-white Blast Cleaning

8. SP13 – Surface Preparation of Concrete

B. National Sanitation Foundation (NSF)

1. NSF International (NSF) Standard No. 61 – Drinking Water System Components – Health Effects.

2. NSF International (NSF) Standard No. 600 – Health Effects Evaluation and Criteria for Chemicals in Drinking Water.

C. Occupational Safety and Health Administration (OSHA).

1.3 SUBMITTALS

A. As specified in Section 01 33 00, Submittal Procedures.

B. Coating Materials List:

1. Provide a coating materials list which indicates the Manufacturer and the coating number, keyed to the coating systems herein.

C. Coating Manufacturer's and Applicator Information -- For each coating system to be used, submit the following listed data.

1. Manufacturer's data sheet for each product used, including statements on the suitability of the material for the intended use.

2. Manufacturer's instructions and recommendations on surface preparation and application.

3. Colors available for each product and each coat.

4. Compatibility of shop and field applied coatings (where applicable).

5. Material safety data sheet for each product used.

6. The Manufacturer’s recommended products and procedures for field coating repairs and field preparation of field cut pipe ends.

7. The name of the proposed coating applicator shop along with certification that the applicator shop is qualified and equipped to apply the coatings systems as specified.

8. Certificate

a. Submit Manufacturer's certificate of compliance with the specifications and standards signed by a Manufacturer’s representative.

9. Samples

    a. Provide painted surface areas at the job for approval of main color selections or submit sample on 12-inch sample of substrate using required finish system at Engineer's discretion.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications:

1. The Applicator Contractor must be capable of performing the various items of work as specified. Furnish a statement covering experience on similar work, a list of machinery, plant, and other equipment available for the proposed work, and a financial statement, including a complete statement of the Applicator Contractor's financial ability and experience in performing similar painting and coating work. Requirements for the Applicator Contractor include a minimum of 5 years practical experience and a successful history in the application of the specified products to concrete/steel surfaces. Provide a list of project references to Engineer for review.

B. Provide the Engineer a minimum of 3 days advance notice of the start of any field surface preparation work of coating application work, and a minimum of 7 days advance notice of the start of any shop surface preparation work.

C. Perform Work only in the presence of the Engineer unless the Engineer has granted prior approval to perform such work in its absence.

D. Inspection by the Engineer, or the waiver of inspection of any portion of the work, does not relieve the Contractor of its responsibility to perform the work in accordance with these Specifications.

E. Surface Preparation - Evaluation of blast cleaned surface preparation work will be based upon comparison of the blasted surfaces with the standard samples available from AAMP.

F. Erect and move scaffolding to locations where requested by the Engineer to facilitate inspection.

1. Provide additional illumination to cover all areas to be inspected.

G. Paint Products – Approval for request for substitution for products decreasing the film thickness designated or the number of coats to be applied, or which offers a change from the generic type of coating specified will not be granted.

1. Coordinate with Engineer and Owner to schedule painting to maintain dust-free and neat work. Paint in strict accordance with the Manufacturer's instructions and perform Work satisfactory to the Engineer.

H. Manufacturer's Representative - Require Coating Manufacturer's representative to be at job site when the first day's coating application is in progress and periodically during progress of the work.

I. Labels - Deliver to the job site in the original sealed containers with Manufacturer's name, product name, type of product, Manufacturer's specification or catalog number or federal specification number, and instructions for reducing where applicable.

J. Colors - Colors will be selected from Manufacturer's standard colors as reviewed by Engineer and approved by the Owner. Colors for special coatings that are limited in their availability and color selection will be chosen on the basis of Manufacturer's standard colors, provided that the Manufacturer's product line represents a color range comparable to similar products of other manufacturers.

K. Flame Spread - Provide paint materials which will result in a Class II finish for all coated surfaces in exit corridors, and a Class III finish for all other interior rooms or areas.

L. Film Thickness Testing:

1. On ferrous metals, measure the dry film coating thickness in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gauge

    a. Manufacturers

        1) Mikrotest model FM.
        2) Elcometer model 456.
        3) Or equal.

2. Test each coat for the correct thickness. Measurements are allowed at least 8 hours after application of the coating.

3. On non-ferrous metals and other substrates, measure the coating thickness at the time of application using wet film gauge readings and destructive film thickness tests.

M. Inspection Device.

1. Furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and measurement of dry-film thicknesses of protective coatings.

    a. Provide dry-film thickness gauges for Engineer’s use while coating is being done, until final acceptance of such coatings.

    b. Provide the services of a trained operator of the holiday detection devices until the final acceptance of such coatings.

N. Holiday Testing.

1. Holiday test all coated ferrous surfaces. Mark and repair or recoat areas containing holidays in accordance with the Coating Manufacturer's printed instructions and then retested.

a. Coatings With Thickness Exceeding 20 Mils DFT:

1) For surfaces having a total dry film coating thickness exceeding 20 mils, provide a pulse-type holiday detector.

a) Tinker & Rasor Model AP-W, D.E. Stearns Co, Model 14/20.
b) Or equal.

2) Adjust the unit to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.

b. Coatings With Thickness of 20 Mils DFT or Less:

1) For surfaces having a total dry film coating thickness of 20 mils or less:

a) Tinker & Rasor Model M1 nondestructive type holiday detector.
b) Or equal.

2) Operate the unit at less than 75 volts.

a) For thicknesses between 10 and 20 mils, add a non-sudsing type wetting agent to the water prior to wetting the detector sponge.

(1) Kodak Photo-Flo.
(2) Or equal.

2. Test in accordance with AWWA SP0188.

1.5 DELIVERY, HANDLING, AND STORAGE

A. Deliver in labeled containers as specified above and store in a locked room accessible for inspection.

1. Comply with local and federal fire and health regulations.

B. Provide adequate heat and forced mechanical ventilation for health, safety, and drying requirements. Use explosion proof equipment. Provide face masks.

C. Protect adjacent surfaces with suitable masking and drop cloths as required.

1. Remove cloth or waste from the Project daily.

D. Apply to surfaces under recommended environmental conditions and within the limitations established by the Material Manufacturer. Do not apply coating in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or to damp or wet surfaces, unless otherwise permitted by the Coating Manufacturer's printed instructions. Coating application may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the Paint Manufacturer during application and drying periods.

1.6 PROTECTION

A. Follow all safety recommendations of Manufacturer regarding ventilation and danger from explosion or breathing paint fumes or skin exposure, and applicable OSHA and federal and local regulations.

B. Protect surface adjacent to work being coated from overspray, drips, or other damage.

1.7 PIPING COLOR CODE

A. As shown on the Drawings

1. In situations where two colors do not have sufficient contrast to easily differentiate between them, a six-inch band of contrasting color should be on one of the pipes at approximately 30-inch intervals.

2. The name of the liquid or gas, along with directional arrows indicating the direction of flow shall be on the pipe.

3. When a color is not specified, coordinate with Owner for color selection.

PART 2 PRODUCTS

2.1 GENERAL

A. The terms "paint," "coatings," or "finishes" as used herein, includes surface treatments, emulsions, enamels, paints, epoxy resins, tape, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat. The term "DFT" means minimum dry film thickness.

B. Seal coating materials in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, Manufacturer's directions, and name of Manufacturer, legibly at the time of use.

C. Use coating materials suitable for the intended use and recommended by their Manufacturer for the intended service.

D. Compatibility - In any coating system, provide only compatible materials from a single manufacturer. Provide particular attention to compatibility of primers and finish coats. If necessary, subject to the approval of the Engineer, apply a barrier coat between existing prime coat and subsequent field coats to ensure compatibility.

E. Colors – Selection of colors and shades of colors of coatings by the Owner. Provide each coat with a slightly different shade, to facilitate inspection of surface coverage of each coat. Select finish colors from the Manufacturer's standard color samples by the Owner**.** Provide lead free color pigments.

F. Protective Coating Materials - Provide the standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, provide the Engineer with the names of not less

than 10 successful applications of the proposed Manufacturer's products demonstrating compliance with this specification requirement.

2.2 INDUSTRIAL COATING SYSTEMS

A. General

1. Provide and apply the industrial coatings systems which follow as listed in the coating schedule, as required by these specifications, and as directed by the Engineer. Coat existing surfaces, new surfaces, submerged surfaces, and intermittently submerged surfaces as indicated in the Drawings and Schedule. Use Coating System Numbers listed below as the Coating System code letter and include reference of Coating System Number on any coating submittals or correspondence.

B. Industrial coating systems:

1. Coating System 102

a. Location - Unprimed or non-galvanized, continuously or intermittently submerged metal items, both interior and exterior including piping, structural steel, and all other metal items not otherwise specified.

b. Surface Preparation

1) SSPC-SP13 to ICRI CSP5 minimum and as specified herein.

c. Coating System

1) Primer: Tnemec Series N69F Hi-Build Epoxoline II, applied at 6.0-8.0 mils DFT; Finish: Tnemec Series 22, applied at 16.0 – 20.0 mils DFT.

2) Prime, intermediate and topcoat, 16.0 mils DFT each coat of Carboline Hydroplate 6500.

3) Or equal.

2. Coating System 104

a. Location – Non-submerged, exposed to view, PVC piping.

b. Surface Preparation - As specified herein.

c. Coating System - Apply one coat, 4.0 – 6.0 mils DFT of:

1) Tnemec Series 69 Hi-Build Epoxoline.
2) Sherwin Williams Macropoxy Series 464
3) Carboline Carboguard 60.
4) Or equal.

2.3 MANUFACTURERS

A. Tnemec Company, Kansas City, MO.
B. Carboline Company, Houston, TX.

C. Sherwin-Williams Company, Cleveland, OH.

PART 3 EXECUTION

3.1 STORAGE, MIXING, AND THINNING OF MATERIALS

A. Manufacturer's Recommendations

1. Unless otherwise specified herein, the Coating Manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating be strictly observed.

B. Use protective coating materials within the Manufacturer's recommended shelf life.

C. Storage and Mixing

1. Protect coating materials from exposure to cold weather, and be thoroughly stirred, strained, and kept at a uniform consistency during application. Do not mix coatings of different manufacturers together.

3.2 CORRECTIONS AND CLEANING

A. Touch-up, restore, and leave any damaged, de-laminated or defaced coated surfaces in first class condition.

1. Restore any coated or finished surfaces damaged in fitting or erection.
2. If necessary, refinish an entire surface rather than spot finished. =

3.3 EXTRA STOCK

A. Provide one gallon of each type and color, fully labeled, at completion of job.

3.4 SURFACE PREPARATION

A. General

1. Prepare all surfaces scheduled to receive new coating systems, as required to provide for adequate bonding of the specified coating system to the substrate material. Request review of prepared surfaces by the Engineer prior to proceeding. For existing coated surfaces, hand wash with cleaner or product recommended by Coating Manufacturer to properly prepare existing surface and provide for bonding of coating specified to follow. Remove any loose, peeling or flaking coating, or mildewed areas. Surface preparation minimums as follows:

a. Exposed metal items, non-submerged, unprimed, non-galvanized both interior and exterior, including piping, structural steel and all other metal items not otherwise specified, are required to undergo surface preparation in accordance with SSPC-SP6, "Commercial Blast Cleaning".

b. Exposed metal items, shop primed, both interior and exterior including piping, steel doors, steel ladders to be painted, and railings, and all other metal items not otherwise specified, are required to undergo surface preparation in accordance with SSPC-SP1, "Solvent Cleaning"; SSPC-SP2, "Hand Tool Cleaning"; and SSPC-SP3, "Power Tool Cleaning" as may be required to remove grease, loose, or peeling or chipped paint.]

c. Metal items, unprimed or non-galvanized, continuously or intermittently submerged, both interior and exterior including piping, structural steel, and all other metal items not otherwise specified, are required to undergo surface preparation in conformance with SSPC-SP10, "Near-White Blast Cleaning".

d. Polyvinyl Chloride (PVC) – Lightly sand non-submerged, both interior and exterior, process piping and plumbing prior to application of the specified coating system to follow.

3.5 PRIME COATING

A. Shop Primed Metal - Where indicated in the Drawings and following the surface preparation procedures specified herein, apply intermediate and topcoats of the specified paint system to shop primed metal. Verify with the Manufacturer(s) representative of the item(s) to be painted, before application, the compatibility of shop primers with the specified intermediate and topcoat coating systems.

B. Non-Shop Primed Metal and Piping - Prime coat all exposed metal and piping, except stainless steel, received at job site following completion of surface preparation requirements as specified herein. Prime paint in accordance with SSPC PS No. 13.01 for epoxy-polyamide primers. Provide epoxy-polyamide primers in conformance to the standards set forth in SSPC Paint Specification No. 22.

3.6 FIELD PRIME

A. Wherever shop priming has been damaged in transit or during construction, clean and touch up any damaged areas with field primer specified herein or returned to the shop for resurfacing and re-priming, at the Engineer’s discretion. Clean and prime metal items delivered to the job site unprimed as specified herein.

3.7 APPLICATION

A. Thickness - Apply coatings in strict conformance with the Manufacturer's application instructions. Apply each coat at the rate specified by the Manufacturer to achieve the dry mil thickness specified. If material must be diluted for application by spray gun, build up more coating to achieve the same thickness as undiluted material. Correct apparent deficiency of film thickness by the application of an additional coat.

B. Apply to surfaces under recommended environmental conditions and within the limitations established by the Material Manufacturer.

C. Porous Surfaces - Apply paint to porous surfaces as required by increasing the number of coats or decreasing the coverage as may be necessary to achieve a durable protective and decorative finish.

D. Paint blast cleaned ferrous metal surfaces before any rusting or other deterioration of the surface occurs. Limit blast cleaning to only those surfaces that can be coated in the same working day.

E. Apply coatings in accordance with the Manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.

F. Provide special attention to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe coating for these areas.

G. Provide special attention to materials which will be joined so closely that proper surface preparation and application are not possible.

H. Coat prior to assembly or installation.

I. Ventilation - Adequately ventilate enclosed rooms and spaces during painting and drying periods.

J. Drying Time - Do not apply next coat of coat until each coat is dry. Test non-metallic surfaces with moisture meter. The Manufacturer's recommended drying time means an interval under normal condition to be increased to allow for adverse weather or drying conditions. Manufacturer's representative to verify by cure testing, complete cure of coatings systems used for immersion service.

END OF SECTION

SECTION 10 14 00 – BUILDING SIGNAGE

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide building signage and appurtenant WORK, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. Americans with Disabilities Act (ADA): ADA Accessibility Guidelines (ADAAG).

C. Building Code: Refer to the Drawings to determine which Building Code applies. The applicable Building Code, defined by the Drawings, is referred to herein as "the CODE."

D. National Fire Protection Association (NFPA):

NFPA 704 Identification of the Hazards of Materials for Emergency Response

E. Occupational Safety and Health Administration (OSHA).

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Literature: Manufacturer's specifications, technical data, installation methods, and maintenance instructions, and the following:

1. Manufacturer's full range color charts, indicating custom color availability for color selection by OWNER.

C. Warranty: Submit a copy of the warranty.

D. Certifications:

1. Certification by the building signage Manufacturer that the building signage provided is suitable for, and compatible with, the required installation.

2. Certification by the building signage Manufacturer that the building signage provided is suitable for, and compatible with, the substrates and surfaces indicated.

3. Certification of Manufacturer qualifications demonstrating compliance with the qualifications requirements indicated.

4. When requested by the ENGINEER, furnish other certifications as may be required to demonstrate compliance with the Contract Documents.

E. Shop Drawings: Complete Shop Drawings showing location and detail of installation.

1. Shop Drawings shall be drawn to sufficient scale and shall include dimensions, show elevations and details of construction of each building signage type, schedule of building signage, mounting details, location and installation requirements, thickness of materials, joints, provisions for expansion and contraction, connections, accessories, and trim.

F. Samples: The CONTRACTOR shall submit 2 samples of each of the following. Unless otherwise indicated, samples shall be full size and shall show gauges, configuration, construction, finish and color proposed for the various components. Samples shall be clearly marked to show the Manufacturer's name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by the ENGINEER. Upon approval, the samples shall become the standard for acceptance for the project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the CONTRACTOR from compliance with the Contract Documents.

1. Full-size sample of each typical building signage type.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Building signage shall be provided by a single Manufacturer, unless otherwise indicated.

B. Manufacturer Qualifications:

1. Building signage Manufacturer shall have a minimum of 10 years of building signage manufacturing experience.

2. Building signage Manufacturers shall have the ability to print signs in Spanish.

3. Manufacturers without these qualifications will not be accepted.

1.5 SPECIAL WARRANTY PROVISIONS

A. Furnish Manufacturer's 15-year written warranty to cover defects in materials, products, and manufacturing workmanship.

1. Warranty shall include coverage against chipping, fading, rusting, shattering, or peeling.

B. Warranties shall be non-prorated for the entire warranty period.

C. The term of the warranties shall begin on the date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL

A. Building signage shall be recommended by the Manufacturer for the installation indicated.

B. Building signage shall be suitable for, and compatible with, the required installation.

C. Building signage shall be suitable for, and compatible with, the substrates and surfaces indicated.

2.2 MEN'S AND WOMEN'S RESTROOM SIGNS

A. Etched plaque signs for men's and women's restroom signs shall be **SignEtch I Series** by **ASI-Signage**, or approved equal.

1. Signs shall consist of raised braille characters and conform to ADAAG.

2. Signs shall be 8-inch (203 mm) by 8-inch (203 mm) by 0.125-inches (3.2 mm) aluminum with brushed square edges. Raised surfaces shall have a brushed finish and recessed surfaces shall be painted black, or color as selected by the OWNER. Signs shall be provided with a top coat of urethane spray containing UV inhibitors and antioxidant compounds, and shall be rated for interior and exterior use.

3. Unless otherwise noted, all lettering shall be Helvetica Medium in both upper and lower case, as specified and scheduled.

4. Signs shall be mounted as scheduled, as recommended in writing by the Manufacturer, and as approved by the ENGINEER.

2.3 RESTRICTIVE/CAUTION SIGNS

A. Signs shall be **SetonUltraTuff** by **Seton**, Branford, Connecticut, or approved equal.

B. Signs shall be constructed of a printed polyester film permanently bonded to a rigid fiberglass panel and over-laminated with **Tedlar** by **Seton**, or approved equal, and a total thickness of 0.11-inch (2.8 mm) minimum.

C. Signs shall be 14-inches (356 mm) wide by 10-inches (254 mm) tall in rounded corners. Color of signs and letters shall be in accordance with OSHA standards. All other aspects of the Restrictive/Caution Signs shall be in accordance with OSHA standards. If OSHA standards do not apply, the color shall be red with white letters, 1-inch (25 mm) high.

D. Signs shall be wall and door surface mounted per Manufacturer standard. Signs shall be mounted as scheduled, as recommended in writing by the Manufacturer, and as approved by the ENGINEER.

E. Sign sizes shall be adjusted to suit the number of letters in each sign with a 1 1/2-inch (38.1 mm) minimum border all around. Two lines are permitted. Center justify the letters.

2.4 HAZARD IDENTIFICATION SYSTEM

A. System shall be manufactured by **Seton**, Branford, Connecticut, or approved equal.

1. System shall confirm to NFPA 704.

2. System shall use a diamond-shaped symbol divided into four smaller diamonds.

a. Health hazard diamond (left): blue background with a rating number in contrasting color.

b. Flammability hazard diamond (top): red background with a rating number in contrasting color.

c. Instability hazard diamond (right): yellow background with a rating number in contrasting color.

d. Special hazard diamond (bottom): white background with a rating number in contrasting color.

3. Colors used for the diamonds shall provide an adequate contrast so that the rating numbers are easily identified.

4. Signs mounted on walls and doors shall be high performances plastic signs.

5. Signs adhered to drums and containers shall be vinyl.

6. Unless otherwise noted, exterior signs shall be a minimum of 15-inches (381 mm) by 15-inches (381 mm) and interior signs shall be a minimum of 10-inches (254 mm) by 10-inches (254 mm)

2.5 BUILDING SIGNS

A. Manufacturer and Product, or Equal:

1. Subject to the requirements indicated, provide Manufacturer and product listed below, or equal.

a. Seton Identification Products; Fiberglass, Style No. M0027.

B. Description:

1. Signs shall be high performance fiberglass, constructed of a printed polyester film permanently bonded to a rigid fiberglass panel and over-laminated with a total thickness of 0.10-inch (2.5 mm) minimum.

2. Signs shall be suitable for interior or exterior use, and resist UV light, dirt, and harsh chemicals.

3. Signs shall be 14-inches (355 mm) wide by 10-inches (250 mm) tall with rounded corners. Colors, letters, and other aspects of the signs shall be in accordance with OSHA standards. If OSHA standards do not apply, the color shall be red selected by the ENGINEER, unless otherwise indicated.

4. Sign sizes shall be adjusted to suit the number of letters in each sign with a 1 1/2- inch (38 mm) minimum border. Two lines are permitted. Letters shall be left justified.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 LOCATIONS

A. Signage shall be installed at the locations indicated or as otherwise required by the CODE, ADAAG, NFPA 704, and OSHA. Where a conflict occurs between the requirements of this Section and the references herein, the more stringent shall apply, as directed by the ENGINEER.

B. Where not indicated, signs shall be installed as directed by the ENGINEER.

C. Signs shall be mounted 60-inches (1520-millimeters) above the floor, unless otherwise indicated.

3.3 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after installation.

B. Protect surrounding WORK from damage that may result from operations under this Section.

3.4 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

2. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units shall be rejected.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where building signage will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed building signage.

a. Provide inserts, backing, blocking, anchoring devices, and reinforcements that must be built into other WORK for the installation of building signage and appurtenances. Coordinate delivery with other WORK to avoid delay.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate CONTRACTOR'S acceptance of the substrate, areas, and conditions.

3.5 PREPARATION

A. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

3.6 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with applicable references, with the requirements of the CODE, nfpa 704, OSHA, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the ENGINEER.

B. The CONTRACTOR shall provide corrosion resistant fasteners, anchors, and shims required for a complete installation, and shall be secure, plumb, level, straight, and true to line, allowing for required movement, including expansion and contraction.

C. The CONTRACTOR shall provide separation of dissimilar materials to ensure no galvanic action occurs.

D. Horizontal lines shall be level, and vertical lines shall be plumb.

E. The CONTRACTOR shall block and reinforce walls as required to support building signage, and appurtenances.

3.7 CLEANING, FINISHING, AND PROTECTION

A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of the CONTRACTOR.

2. Residue shall not be left on any surfaces.

B. Upon completion of the installation, building signage and appurtenances shall be cleaned of dirt and other foreign matter to the satisfaction of the ENGINEER.

1. Cleaning shall be performed again immediately prior to acceptance of the WORK, when directed by the ENGINEER.

2. Cleaning shall be performed in accordance with the Manufacturer's written instructions.

C. Building signage shall be protected from damage from subsequent construction operations.

D. The CONTRACTOR shall make adjustments required until accepted.

E. The CONTRACTOR shall remove scratches and blemishes to the satisfaction of the ENGINEER.

F. Damaged or defective items shall be removed and replaced at the direction of the ENGINEER.

G. When building signage WORK is completed, remove unused materials, containers, and equipment, and clean the Site of building signage debris.

3.8 MEN'S AND WOMEN'S RESTROOM SIGN SCHEDULE

Quantity	Sign Wording	Location
2	Unisex Restroom	Unisex Restroom A and B

3.9 RESTRICTIVE/CAUTION SIGN SCHEDULE

Quantity	Sign Wording	Location
4	DANGER Equipment may start without warning	To be located by the ENGINEER.
8	EXIT	Locate on inside of each exit door.
3	CAUTION Non-Potable Water Do not drink	To be located by the ENGINEER.
1	CAUTION Vehicle Loading HS20-44	To be located by the ENGINEER.
1	WARNING No Vehicles Beyond This Point	To be located by the ENGINEER.
2	CAUTION MAX LOADING 200 LBS	Each side of Electrical Room
8	EXIT DO NOT BLOCK DOOR	Exterior of each exterior door Others as directed by the ENGINEER.

3.10 HAZARDOUS IDENTIFICATION SYSTEM SIGN SCHEDULE – MEETING THE REQUIREMENTS OF NFPA 704

Quantity	Sign Wording	Location
4	ALUMINUM SULFATE, 48% 2 0 0 IRRITANT	ON TANKS AND BUIDLING EXTERIOR
4	SODIUM HYPOCHLORITE, 0.8% 2 0 0 IRRITANT	ON TANKS AND BUIDLING EXTERIOR
5	SODA ASH, 100% 2 0 0 IRRITANT	ON TANKS AND BUIDLING EXTERIOR
2	POLYMER, 100% 2 0 0 IRRITANT	ON TANKS AND BUIDLING EXTERIOR
2	BRINE (SODIUM CHLORIDE), 48% 2 0 0 IRRITANT	ON TANKS AND BUIDLING EXTERIOR
2	POLYMER, 100% 2 0 0 IRRITANT	ON TANKS AND BUIDLING EXTERIOR

3.11 BUILDING ROOM SIGN SCHEDULE

Quantity	Sign Wording	Location
1	JANITOR	JANITOR
1	KITCHEN	KITCHEN
3	MEETING ROOM	MEETING ROOM
1	ENTRY	ENTRY (EXTERIOR)
2	CHEMICAL ROOM	CHEMICAL ROOM (EXTERIOR)
2	ELECTRICAL ROOM	ELECTRICAL ROOM (1 EXTERIOR/ 1 INTERIOR)
2	MECHANICAL ROOM	MECHANICAL ROOM (1 EXTERIOR/ 1 INTERIOR)
1	STORAGE	STORAGE

3.12 BUILDING SIGN SCHEDULE

Quantity	Sign Wording	Location
1	Water Quality Systems Building	Water Quality Systems Building

END OF SECTION

SECTION 10 28 13 – TOILET AND SHOWER ACCESSORIES

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide toilet accessories and appurtenant WORK, complete, in place, and operational in accordance with the Contract Documents.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. American National Standards Institute (ANSI):

A117.1 Accessible and Useable Facilities

C. Americans with Disabilities Act (ADA):

ADAAG Americans with Disabilities Accessibility Guidelines

D. Building CODE: Refer to the Drawings to determine which building code applies within a given jurisdiction. The applicable building code, defined by the Drawings, is referenced herein as “the CODE.”

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. Literature: Manufacturer’s specifications, technical data, installation methods, and maintenance instructions.

C. Warranty Submit a copy of the warranty.

D. Certifications:

1. Certification by an independent testing organization demonstrating that grab bar strength and installation complies with the requirements indicated.

2. Certification of installer qualifications demonstrating compliance with the qualifications requirements indicated. Include a list of 5 similar completed projects with addresses of the project location, date of project completion, and contact information of the consultant firm of record, general contractor and owner.

E. Shop Drawings: Complete Shop Drawings showing location and detail of installation.

F. Samples: When requested by the ENGINEER, submit samples of the materials proposed. Samples shall be clearly marked to show the Manufacturer’s name, product identification, finish and color. New samples shall be resubmitted of each, as required, until approved by the ENGINEER. Upon approval, the Samples shall become the standard for acceptance for the

project with regard to color, finish, and quality of each item. Approval of samples shall not relieve the CONTRACTOR from compliance with the Contract Documents.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Toilet and shower accessories shall be provided from a single Manufacturer.

B. Installer Qualifications:

1. A minimum of 5 years' experience in the successful completion of at least 5 projects of similar size and scope, employing similar products, materials, applications, and performance requirements.

2. Installers without these qualifications will not be accepted.

1.5 SPECIAL WARRANTY PROVISIONS

A. A. Furnish the Manufacturer's written 10 year warranty for mirrors to cover silver spoilage. The term of the warranty shall begin on the date of Substantial Completion.

PART 2 PRODUCTS

2.1 TOILET ACCESSORIES

A. Manufacturer, or Equal:

1. Subject to the requirements indicated, provide products from one of the Manufacturers listed below, or Equal

a. Bobrick Washroom Equipment, Inc.
b. Bradley Corporation.
c. American Specialties, Inc.

B. Description:

1. Accessories shall be satin finish stainless steel unless otherwise indicated.

2. Grab bars shall be provided with peened gripping surface.

3. Provide items complete with screws, bolts, and anchoring devices required for proper installation.

4. Provide units complete with anchorages, reinforcements, backing, and blocking for securing the toilet and shower accessories to other WORK.

2.2 ACCESSORIES SCHEDULE

A. Refer to the Drawings for locations and quantities of item numbers indicated below:

Item Number	Description	Manufacturer Product / Model Number, or Equal
GB18	18-inch (91 cm) Grab Bar, Vertical	BOBRICK MODEL B-6806.99 X 18
GB36	36-inch (91 cm) Grab Bar	BOBRICK MODEL B-6806.99 X 36
GB42	42-inch (107 cm) Grab Bar	BOBRICK MODEL B-6806.99 X 42
SMTP	Surface Mounted Toilet Paper Dispenser	BOBRICK MODEL B-2888
SMSC	Surface Mounted Toilet Seat Cover Dispenser	BOBRICK MODEL B-4221
PTWR	Surface Mounted Paper Towel Dispenser and Waste Receptacle	Bradley Corp Model 2028-11
SMSD	Surface Mounted Soap Dispenser	BOBRICK MODEL 818615
MS	Mirror, Channel Frame with Shelf (tempered glass)	BOBRICK MODEL B-1668 X 1836
US	Utility Shelf with Mop/Broom Holder	BOBRICK MODEL B-239 X 34
HS	Hook Strip	BOBRICK MODEL B-232 X 24
SN	Wall Mounted Sanitary Napkin Disposal	BOBRICK MODEL B-270

2.3 FABRICATION

A. The CONTRACTOR shall field verify size, location, and placement of toilet and shower accessories, shall advise the ENGINEER in writing of any necessary adjustments, and shall make the necessary adjustments prior to fabrication. The CONTRACTOR shall coordinate field measurements and shop drawings with fabrication and shop assembly to minimize field adjustments.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Site in Manufacturer's original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer's written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer's written instructions.

3.2 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

2. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units shall be rejected.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where toilet and shower accessories and related items will be installed for compliance with requirements for installation, taking into account tolerances, and other conditions affecting performance of installed toilet and shower accessories.

a. Provide inserts, backing, blocking, anchoring devices, and reinforcements that must be built into other WORK for the installation of toilet and shower accessories. Coordinate delivery with other WORK to avoid delay.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate CONTRACTOR's acceptance of the substrate, areas, and conditions.

3.3 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with the requirements of The CODE, ADAAG, and ANSI A 117.1 ith applicable referenced standards, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the ENGINEER.

B. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

C. The CONTRACTOR shall provide corrosion resistant fasteners, anchors, and shims required for a complete installation, and shall be secure, plumb, level, straight, and true to line, allowing for required movement, including expansion and contraction.

1. Use fasteners appropriate to substrate as recommended in writing by the Manufacturer. Unless otherwise indicated, provide tamper-proof, theft-resistant, concealed mounting devices and fasteners, as recommended in writing by Manufacturer.

2. Install units in locations and at heights indicated.

a. Where heights and locations are not indicated, such items shall be installed where directed by the ENGINEER.

3. Coordinate location of concealed supplemental blocking, backing, and additional anchoring reinforcement with items to be installed herein.

D. The CONTRACTOR shall provide separation of dissimilar materials to ensure no galvanic action occurs.

3.4 CLEANING, FINISHING, AND PROTECTION

A. Adhesive papers used for masking, which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Film and labels left in place after installation shall be the responsibility of the CONTRACTOR.

2. Residue shall not be left on any surfaces.

B. Upon completion of the installation, toilet and shower accessories and appurtenances shall be cleaned of all dirt and other foreign matter to the satisfaction of the ENGINEER.

1. Cleaning shall be performed again immediately prior to acceptance of the WORK, when directed by the ENGINEER.

2. Cleaning shall be performed in accordance with the Manufacturer's written instructions.

C. Toilet and shower accessories shall be protected from damage from subsequent construction operations.

D. The CONTRACTOR shall remove scratches and blemishes to the satisfaction of ENGINEER.

E. Damaged or defective items shall be removed and replaced at the direction of the ENGINEER.

F. When toilet and shower accessories WORK is completed, remove unused materials, containers, and equipment, and clean the Site of toilet and shower accessories debris.

END OF SECTION

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SECTION 10 44 00 - FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide fire extinguishers and appurtenant WORK, complete, in place, and operational in accordance with the Contract Documents.

1.2 REFERENCES

A. Where reference is made to any of the below, the revision in effect at the time of bid opening shall apply.

B. Building Code: Refer to the Drawings to determine which building code applies. The applicable building code, defined by the Drawings, is referenced herein as “the CODE”.

C. National Fire Protection Association publications (NFPA):

NFPA 10 Standard for Portable Fire Extinguishers

D. Underwriter’s Laboratories (UL)

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

1. Literature: Manufacturer’s specifications, technical data, installation methods, and maintenance instructions.

2. Certifications:

a. UL certification for each fire extinguisher unit provided.

b. Certification of Manufacturer qualifications demonstrating compliance with the qualifications requirements indicated.

3. When requested by the ENGINEER, furnish other certifications as may be required to show compliance with the Contract Documents.

4. Shop Drawings: Complete Shop Drawings showing location and detail of installation. Shop Drawings shall include mounting and bracket details.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Fire extinguishers shall be provided by a single Manufacturer.

B. Manufacturer Qualifications:

1. Fire extinguisher Manufacturer shall have a minimum of 20 years of fire extinguisher manufacturing experience.

2. Manufacturers without these qualifications will not be accepted.

PART 2 PRODUCTS

2.1 GENERAL

A. Fire extinguishers, accessories, and installation shall comply with the CODE, NFPA 10, and with the Manufacturer's published recommendations and specifications.

2.2 FIRE EXTINGUISHERS

A. Manufacturer, or Equal:

1. Subject to the requirements indicated, provide products from one of the Manufacturers listed below, or Equal.

a. J.L Industries, Inc.
b. Larsen’s Manufacturing Co.
c. General Fire Extinguisher Co.

B. Description:

1. Fire extinguishers in every location, except in rooms or spaces containing electrical switchgear, motor control centers, variable frequency drives, generator rooms, etc., shall be 20 lb capacity, 6A:120BC (ABC), UL-rated, chemical multipurpose type.

2. Fire extinguishers in rooms or spaces containing electrical switchgear, motor control centers, variable frequency drives, generator rooms, etc., shall be 20 lb capacity 10 BC, UL-rated, carbon dioxide type.

3. Fire extinguishers shall be provided with severe duty corrosion resistant finish, red enamel steel cylinders.

4. Fire extinguishers shall be provided with mounting brackets, which support the bottom and sides of extinguishers, and are specially designed for the extinguisher, as recommended in writing by the Manufacturer.

2.3 ADDITIONAL EXTINGUISHERS

A. Provide 1 additional ABC units and 1 additional BC units to be located as directed.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in Manufacturer’s original, unopened packages, containers, or bundles with labels intact, which clearly identify contents.

B. Store materials carefully in accordance with the Manufacturer’s written instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the products.

C. Handle materials in strict accordance with Manufacturer’s written instructions.

3.2 LOCATIONS

A. The CONTRACTOR shall verify the fire extinguisher locations and mounting heights on the Contract Drawings with the Fire Marshall before installation. If locations on the Drawings are not accepted by the Fire Marshal, install fire extinguishers where directed by the ENGINEER.

3.3 PROJECT CONDITIONS

A. Comply with Manufacturer's written instructions for environmental conditions before, during, and after installation.

B. Protect surrounding WORK from damage that may result from operations under this Section.

3.4 INSPECTION

A. The CONTRACTOR shall be totally responsible for the proper performance and completion of the WORK under this Section.

B. Systems and components shall be inspected before installation.

1. Damaged or defective items shall be rejected and marked as such and shall be removed from the Site.

2. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units shall be rejected.

C. The CONTRACTOR shall verify dimensions, tolerances, and method of attachment with adjacent WORK.

1. Examine substrates, areas, and conditions where fire extinguishers and appurtenances will be installed for compliance with the requirements for installation, taking into account tolerances, and other conditions affecting performance of installed fire extinguishers and appurtenances.

a. Provide inserts, backing, blocking, anchoring devices, and reinforcements that must be built into other WORK for the installation of fire extinguishers and appurtenances. Coordinate delivery with other WORK to avoid delay.

2. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the WORK. Do not proceed with the WORK until unsatisfactory conditions have been corrected in an acceptable manner.

3. Commencement of the installation by the CONTRACTOR shall indicate CONTRACTOR's acceptance of the substrate, areas, and conditions.

3.5 PREPARATION

A. Sequence installation properly with the installation and protection of other WORK, so that neither will be damaged by the installation of the other.

3.6 INSTALLATION

A. Installation shall comply with the requirements of the Contract Documents, with applicable references, the requirements of the CODE, with NFPA 10, and with Manufacturer's written instructions. Where a conflict occurs among these requirements, the more stringent shall apply, as directed by the ENGINEER.

B. The CONTRACTOR shall block and reinforce walls as required to support the fire extinguishers and appurtenances.

C. The CONTRACTOR shall provide corrosion resistant fasteners, anchors, and shims required for a complete installation, and shall be secure, plumb, level, straight, and true to line, allowing for required movement, including expansion and contraction.

D. The CONTRACTOR shall provide separation of dissimilar materials to ensure no galvanic action occurs.

E. Horizontal lines shall be level, and vertical lines shall be plumb.

F. Secure mounting brackets and fire extinguishers to structure, square and plumb.

3.7 CLEANING, FINISHING, AND PROTECTION

A. Adhesive papers used for masking which become firmly bonded when exposed to heat and/or light shall not be used.

1. Remove masking film and temporary labels as soon as possible after installation. Films and labels left in place after installation shall be the responsibility of the CONTRACTOR.

2. Residue shall not be left on any surfaces.

B. Upon completion of the installation, fire extinguishers and appurtenances shall be cleaned of dirt and other foreign matter to the satisfaction of the ENGINEER.

1. Cleaning shall be performed again immediately prior to acceptance of the WORK, when directed by the ENGINEER.

2. Cleaning shall be performed in accordance with the Manufacturer's written instructions.

C. Fire extinguishers shall be protected from damage from subsequent construction operations.

D. The CONTRACTOR shall make adjustments required until accepted.

E. The CONTRACTOR shall remove scratches and blemishes to the satisfaction of the ENGINEER.

F. Damaged or defective items shall be removed and replaced at the direction of the ENGINEER.

G. When fire extinguishers WORK is completed, remove unused materials, containers, and equipment, and clean the Site of fire extinguishers debris.

H. Fire extinguishers shall be inspected and certified within 30 days of Substantial Completion.

END OF SECTION

SECTION 10 56 13 – STORAGE SHELVING

PART 1 GENERAL

1.1 DESCRIPTION

A. This section includes materials and installation of metal shelving.

B. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 SUBMITTALS

A. Submit manufacturer's catalog data and dimensional drawings of shelving.

B. Submit anchorage calculations prepared and signed by a Professional Engineer, registered to practice in the State of Oregon verifying that the building system design and foundation design meet indicated loading requirements and codes of authorities having jurisdiction.

1. Design shall reference specific loads capable of supporting up to four (4) bulk soda ash super sacks (~2,000 lbs each).

PART 2 MATERIALS

2.1 MANUFACTURERS

A. Steel Shelving shall be tear-drop design manufactured by RIDG-U-RAK, Husky, or equal.

2.2 STEEL SHELVING

A. Shelving shall be open units as shown in the drawings

B. Shelving shall be modular tear-drop wire rack design.

C. Shelving shall have standard heavy duty 3-inch x 3-inch post construction

D. Shelving shall have 4.10L x 96-inch beam providing 5,200 lb capacity per pair of beams.

E. Each post and beam uses the standard "teardrop" design, which is compatible with all other standard teardrop pallet rack made by other manufacturers

F. Created from high-quality pre-galvanized 6-gauge wire and 14-gauge pre-galvanized channels

PART 3 EXECUTION

Install shelving per manufacturer's instructions.

END OF SECTION

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SECTION 22 10 00 – PLUMBING PIPING

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall provide plumbing piping and specialties, complete and operable, as indicated in accordance with the Contract Documents.

B. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Reference Specifications

01 33 00	Submittal Procedures
01 33 17	Structural Design, Support and Anchorage
09 91 00	Painting and Protective Coatings
23 07 00	HVAC Insulation
40 05 07	Hangers and Supports for Process Piping
40 05 63	Ball Valves
43 30 52	Miscellaneous Valves

B. Reference Standards

American National Standards Institute (ANSI)	
NSF/ANSI 61	Drinking Water System Components – Health Effects
ANSI Z21.5a	Vented Decorative Gas Appliances
ANSI B31.8	Gas Transmission and Distribution Piping Systems
American Society of Mechanical Engineers (ASME)	
ASME B1.20.7	Hose Coupling Screw Threads (Inch)
ASME B16.3	Malleable Iron Threaded Fittings: Classes 150 and 300
ASME B16.9	Factory-Made Wrought Buttwelding Fittings
International Organization for Standardization (ISO)	
American Society of Sanitary Engineering (ASSE)	
ASSE 1001	Performance Requirements For Atmospheric Type Vacuum Breakers
American Society for Testing and Materials (ASTM)	
ASTM B88/B88M	Seamless Copper Water Tube
ASTM B32	Solder Metal
ASTM B813	Liquid and Paste Fluxes For Soldering of Copper and Copper Alloy Tube
ASTM A74	Cast Iron Soil Pipe And Fittings
ASTM D1785	Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, And 120

ASTM D2665	Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, And Vent Pipe And Fittings
ASTM D1784	Classification System And Basis For Specification For Rigid Poly(Vinyl Chloride) (PVC) Compounds And Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D2672	Joints For IPS PVC Pipe Using Solvent Cement
ASTM A53	Pipe, Steel, Black And Hot-Dipped, Zinc-Coated, Welded And Seamless
ASTM D2513	Thermoplastic Gas Pressure Pipe, Tube, and Fittings
ASTM D2683	Socket Type Polyethylene Fittings for Outside Diameter – Controlled Polyethylene Pipe and Tubing
ASTM D3261	Butt Heat Fusion Polyethylene Plastic Fittings for Polyethylene Plastic Pipe and Tubing
American Water Works Association (AWWA)	
AWWA C708	Cold-Water Meters – Multijet Type
AWWA C651	Disinfecting Water Mains
AWWA C652	Disinfection of Water Storage Facilities
National Sanitation Foundation (NSF)	
NSF/ANSI 372	Drinking Water System Components – Lead Content
NSF International STD 61	Drinking Water System Components – Health Effects
NSF International Std 14	Plastics Piping System Components And Related Materials
NSF/ANSI Std 61	Drinking Water System Components – Health Effects
Safe Drinking Water Act (SDWA)	
United States Environmental Protection Agency (US EPA)	
Public Law (PL)	
PL 93-523	Safe Drinking Water Act
Cast Iron Soil Pipe Institute (CISPI)	
CISPI Standard 301	Hubless Cast Iron Soil Pipe And Fittings For Sanitary And Storm Drain, Waste, And Vent Piping Applications
Factory Mutual (FM)	
FM standard 1680	Approval Standard For Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems Above and Below Ground, Industrial/Commercial and Residential
International Organization for Standardization (ISO)	
ISO 9001	Quality management systems
Compressed Gas Association (CGA)	
CGA 9.1M	Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop Drawings

1. General arrangement drawings of system components
2. Catalog cuts and other manufacturer information for products

C. Samples: electrically fused test joint for drainage and vent piping

1.4 WORKMANSHIP AND MATERIALS

A. Work shall be in strict accordance with the International Plumbing Code and codes of the State of Florida, Pinellas County, and any other authorities having jurisdiction.

B. The Contractor shall have required certifications and shall be thoroughly familiar with the local codes.

C. The Contractor shall obtain and pay for necessary permits.

D. Protection

1. Care shall be taken at all times to protect floors, stairways, and walls during the make-up and installation of piping and equipment.

2. The Contractor shall remove stains and repair damage before final acceptance of the Work.

E. Identifying Marks

1. If the Engineer finds materials that have identifying marks removed or lack such marks completely, such items will be rejected until the Contractor has furnished proof that said items conform to the Specifications.

2. Adequacy and extent of such proof will be determined by the Engineer.

PART 2 PRODUCTS

2.1 GENERAL

A. Plumbing piping, fixtures, specialties, and equipment shall be as recommended by the manufacturer for the intended usage.

B. Floor drains or floor sinks shall be provided for equipment drains.

C. No equipment drains shall discharge to floor slabs.

D. Any pipe, plumbing fitting or fixture, solder, or flux used in the installation or repair of any public water system or any plumbing in a facility providing water for human consumption, shall be “lead free” except when necessary for the repair of leaded joints of cast iron pipes.

1. Lead free products shall meet or exceed the requirements of the Safe Drinking Water Act (SDWA) – USEPA

2. Lead free is defined as not more than 0.2 percent lead when used with respect to solder and flux; not more than 0.25 percent in the wetted surface material of pipes, pipe fittings, plumbing fittings and fixtures.

2.2 POTABLE WATER

A. Copper tubing and fittings for potable and service water 3-in and smaller shall be Type K copper tube with soldered fittings and shall conform to ASTM B88/B88M

B. Solder containing lead shall not be used with copper pipe.

C. Solder Material: Solder metal shall conform to ASTM B32.

D. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B813, Standard Test 1.

E. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption and shall be certified in accordance with NSF/ANSI 61, Annex G Section 9 or NSF 372.

F. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF/ANSI 61, Section 8. End point devices such as drinking water fountains, lavatory faucets, kitchen and bar faucets, residential ice makers, supply stops, and end point control valves used to dispense water for drinking must meet the requirements of NSF/ANSI 61, Annex G Section 9.

2.3 PVC PIPING AND FITTINGS FOR SANITARY DRAIN, STORM DRAIN AND VENTS

A. PVC Schedule 40 corrosion resistant sanitary pipe, IPS sizes 1/8-in through 24-in, shall be rated for temperatures up to and including 200 deg F, and Pressure rating (120 psi to 810 psi) depending on pipe schedule, pipe size, and temperature as stated in Harvel Plastics, Inc. engineering bulletin (Product Bulletin 112/401). Pipe shall be suitable for PVC plastic drain, waste, and vent (DWV) applications. Pipe material shall be generally resistant to most acids, bases, salts, aliphatic solutions, oxidants, and halogens. Chemical resistance data is available and should be referenced for proper material selection. Pipe exhibit excellent physical properties and flammability characteristics. Typical applications include chemical processing, plating, high purity applications, potable water systems, water and wastewater treatment, drainage, irrigation, agricultural, and other applications involving corrosive fluid transfer.

B. This specification outlines minimum manufacturing requirements for Polyvinyl Chloride (PVC) Schedule 40 iron pipe size (IPS) pressure pipe. This pipe is intended for use in applications where the fluid conveyed does not exceed 200 deg F. This pipe shall meet and or exceed the industry standards and requirements as set forth by the American Society for Testing and Materials (ASTM D1785 and ASTM D2665) and the National Sanitation Foundation (NSF International STD 61 and Std 14).

C. The material used in the manufacture of the pipe shall be domestically produced rigid polyvinyl chloride (PVC) compound, Type I Grade I, with a Cell Classification of 12454 as defined in ASTM D1784, trade name designation H707 PVC. This compound shall be white or gray in color as specified, and shall be approved by NSF International for use with potable water (NSF Std 61).

D. All sizes of PVC Schedule 40 pipe shall be manufactured in strict accordance to the requirements of ASTM D1785 for physical dimensions and tolerances. PVC Sch 40 pipe sizes 1-½-in through 24-in diameters shall also meet the requirements of ASTM D2665 Standard

Specification for PVC plastic drain, waste and vent (DWV) pipe and shall be dual marked as such. Each production run of pipe manufactured in compliance to the standard, shall also meet or exceed the test requirements for materials, workmanship, burst pressure, flattening, and extrusion quality defined in ASTM D1785 and ASTM D2665 as applicable. All belled-end pipe shall have tapered sockets to create an interference-type fit, which meet or exceed the dimensional requirements and the minimum socket length for pressure-type sockets as defined in ASTM D2672. All PVC Schedule 40 pipe must also meet the requirements of NSF Standard 14 rigid PVC pipe for pressure applications, and shall bear the mark of these Listing agencies.

E. Product marking shall meet the requirements of ASTM D1785 and ASTM D2665 as applicable and shall include: the manufacturer's name (or the manufacturer's trademark when privately labeled); the nominal pipe size; the material designation code; the pipe schedule and pressure rating in psi for water at 73 deg F; the ASTM designation ASTM D1785; the ASTM designation ASTM D2665 (when dual marked); the independent laboratory's seal of approval for potable water usage; and the date and time of manufacture.

F. All PVC Schedule 40 pipe shall be manufactured from a Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784. The pipe shall be manufactured in strict compliance to ASTM D1785 and ASTM D2665 (where applicable), consistently meeting and/or exceeding the Quality Assurance test requirements of these standards with regard to material, workmanship, burst pressure, flattening, and extrusion quality. The pipe shall be manufactured in the USA, using domestic materials, by an ISO 9001 certified manufacturer. Standard lengths of pipe sizes 6-in and larger shall be beveled each end by the pipe manufacturer. All pipe shall be stored indoors after production at the manufacturing site until shipped from factory. This pipe shall carry the National Sanitation Foundation (NSF) seal of approval for potable water applications.

2.4 INSULATION

A. Hot and cold water piping, valves, fittings, and exposed horizontal sanitary, storm, and vent piping shall be provided with 1-in thick insulation in accordance with the requirements of Section 23 07 00 – HVAC Insulation.

B. Coverings

1. Cover valves, flanges, fittings, and ends-of-insulation with a pre-molded high- and low-temperature PVC fitting cover, end cap, or similar pre-formed unit.

2. The pre-formed covers shall be sized to receive the same thickness of insulation as used in the adjacent piping and shall be in accordance with Section 23 07 00 – HVAC Insulation.

C. Exposed Piping

1. Exposed supply and drain piping shall be insulated and jacketed with ADA compliant safety cover under all lavatories in order to prevent burns and abrasions to handicapped persons.

2. Removable insulated covers shall be Plumberex Specialty Products Handy-Shield type, or equal.

2.5 HANGERS, SUPPORTS, AND MISCELLANEOUS METAL WORK

A. General

1. For utility piping such as cold water, hot water, compressed and vacuum air, and sanitary drain pipes located inside the building, the Contractor shall provide hangers and supports for vertical, axial, and seismic loads in accordance with the Code, and per Section 01 33 17 – Structural Design, Support and Anchorage.

2. No perforated strap hangers nor wire supports will be permitted.

3. The Contractor shall obtain the services of a registered mechanical or structural professional engineer for design of the supports, and the Shop Drawings showing installation shall be stamped by the registered engineer.

4. Pipe supports shall be as indicated in Section 40 05 07 – Hangers and Supports for Process Piping.

B. Hangers supporting insulated piping shall be sized to fit the pipe plus the insulation.

C. Insulation at support points shall be provided with metal shields in order to prevent damage to the insulation.

D. Spacing

1. Pipe support spacing for steel and cast-iron pipe shall be as indicated in Section 40 05 07 – Hangers and Supports for Process Piping.

2. Copper tube support spacing shall be not more than 6 ft between supports.

E. Rod sizes for pipe hangers shall be as recommended by the hanger manufacturer.

F. Pipe hangers used to support uninsulated copper tube shall be constructed of copper or copper plated.

G. Vertical piping shall be supported at the base with fittings made for this purpose or shall be supported from the nearest horizontal member or floor with a riser extension pipe clamp.

H. Inserts

1. Anchors that are installed into existing concrete shall be Grinnell Figure 117, Modern Figure 740, or equal, expansion case inserts.

2. Drill clean holes for the insertion of case and patch concrete around the hole, as required.

3. Continuous-slotted concrete inserts, if used, shall be Crawford Figure 148, Fee and Mason Figure 9000, or equal.

4. The Contractor shall provide secondary angle supports between main inserts in order to handle the loads which can be properly supported by such arrangement.

5. Concrete inserts shall be as indicated in Section 40 05 07 – Hangers and Supports for Process Piping.

6. Inserts shall be galvanized.

2.6 VALVES

A. Water shutoff valves shall be of the ball valve type, including on fixture supply piping.

B. Ball valves shall be in accordance with the requirements of Section [40 05 63- Ball Valves.

C. Ball Shut-Off Valves

1. Provide ball shut-off valves on cold water piping at entrances to pipe chases and other inaccessible areas and wherever indicated or required to obtain the maximum efficiency for shut-off control on the water system.

2. Ball shut-off valves shall be placed on hot and cold water connections to equipment and fixtures.

3. Show the locations of shut-off valves on the Shop Drawings.

2.7 ACCESS DOORS AND COVERS

A. Access doors, where required in ceilings for access to valves, controls, and other equipment, shall be Karp Assoc., Style DSC-210, Inryco-Milcor, Style AT, or equal.

B. The doors shall be of sufficient size to allow access but shall be not less than 12-in by 12-in.

C. Ceilings with lay-in acoustical tile do not require access panels.

D. Valves and equipment located above ceiling tile shall have a ¾-in diameter blue plastic button with a letter "V" set in the tile.

E. Floor Covers

1. Floor access covers in unfinished concrete floors not exposed to chemicals shall be constructed of galvanized cast iron with a clear opening of not less than 8-in by 8-in, and shall be Alhambra Foundry Company, Model A-2015, Neenah Foundry Co., No.R-6687, or equal.

2. In traffic or chemical areas, access covers shall be Alhambra Foundry Company, Model A-1240, Neenah Foundry Co., Model R-1977, or equal, with a clear opening of not less than 10-in in diameter.

2.8 FLOOR DRAINS IN TILED FLOORS

A. Floor drains in shower rooms and other finished or tiled floors shall be provided with a 5-in 127 mm nickel-bronze strainer and cast-iron body in the sizes indicated, and where located on upper floors provided with a clamping collar with 4 lbs 1.8 kg sheet lead flashing 12-in 304.8 mm minimum all around.

B. Manufacturers, or Equal

1. Josam Mfg. Co., Series 30 000-A
2. Jay R. Smith Mfg. Co., Fig. 2010-A

3. Zurn Industries, Inc., Series ZN-415-C

2.9 FLOOR DRAINS IN CONCRETE FLOORS

A. Floor drains in concrete floors shall be constructed of cast iron, in the sizes indicated, and provided with sediment buckets.

B. Each floor drain located on an upper floor shall have a clamping collar, with 4 lbs 1.8 kg sheet lead flashing 12-in 304.8 mm minimum all around.

C. Where lead flashing does not comply with the Code, use epoxy waterproofing material, and submit a Shop Drawing for review.

D. Manufacturers, or Equal

1. Josam Mfg. Co., Series 32100-AE-81
2. Jay R. Smith Mfg. Co., Fig. 2350
3. Zurn Industries, Inc., Series Z-520-Y

2.10 ELECTRIC ACTUATED TYPE TRAP PRIMER

A. Where required by the Code, floor drains and floor sinks connected to the sanitary sewer shall be furnished with trap primers connected to the water supply.

B. Run ½-in copper tubes from the primers to the traps.

C. Trap primers shall be surface mounted in accessible locations.

D. Factory programmed, 4 to 30 port manifold, Electronic Trap Primer providing automatic trap priming.

E. Unit will supply a minimum of 2 oz of potable water at 20 PSIG at a preset factory setting of 6 seconds every 24 hours. The entire unit is pre-assembled in a NEMA 1 galvanized steel surface mounted housing and cover.

F. ¾ FNPT inlet connection, brass ball-type stop valve, 120 VAC solenoid valve, brass atmospheric vacuum breaker, 5/8 or 1/2 outlet compression fittings.

G. Anti-Siphon atmospheric vacuum breaker meets Los Angeles code, IAPMO, New York Board of Standards, ASSE 1001 and CSA.

H. Electrical 2 amp Circuit Breaker, Manual Over Ride Switch/Test Button, Timer, 120 VAC Solenoid Valve marked as UL listed. 2 wire plus ground, hold current 0.13 Amps, in rush 0.28 amps.

I. Manufacturers, or Equal

1. Precision Plumbing Products, Model PTS
2. Zurn Industries, Inc.

2.11 CLEANOUTS

A. Cleanouts shall be heavy plugs with tapered shoulders against caulked lead or heavy brass plugs.

B. Where underground or concealed, cleanouts shall be brought to floor level and to accessible locations with access covers and frames.

C. Manufacturers, or Equal

Service	Josam Series	J.R. Smith No.	Zurn No.
Exposed Locations	58500-20	4405	Z-1440-A
Underground (finished floors)	56010/30	4143	ZN-1400-2
Walls, Concealed	58790-20	4535	ZN-1445-1-A

D. Cleanouts shall have a minimum diameter of 3-in.

E. Stack cleanouts shall be installed at the base of each stack.

F. Cleanouts shall be fabricated from galvanized cast iron with ABS plastic cleanout plugs.

2.12 HOSE BIBBS AND HYDRANTS

A. Hose bibbs and hydrants in exposed locations subject to freezing shall be the non-freeze type.

B. Hose bibbs connected to a non-potable water supply shall be provided with plastic or stainless steel warning signs reading "DO NOT DRINK" in clearly legible letters, permanently attached at the hose bibb.

C. Hose bibbs shall be provided with vacuum breakers as furnished by Crane Co., American Standard, or equal.

D. Manufacturers or Equal

Drawing Callout	Fixture Type	Description
HB-1	Indoor Hose Bibb	Exposed, anti-siphon, wall faucet for indoor installation, complete with Z1399-BFP external backflow preventer, all bronze interior components, vandal-resistant operating stem, rough bronze exterior and ¾ male hose connection (Conform to ASME B1.20.7). Zurn Industries, Inc., Model Z1341-BFP

2.13 SHOCK ABSORBERS

A. Building cold and hot water piping that is connecting self-closing faucets, quick-action valves, water closets, emergency showers, washers, and dishwashers, shall be protected by shock absorbers located at each fixture or battery of fixtures.

B. Shock absorbers shall be corrosion-resistant, permanently sealed, and shall be sized and installed to the manufacturer's printed recommendations.

C. Manufacturers, or Equal

1. Josam "SHOKTROLS"
2. Jay R. Smith “HYDROTROL"
3. Zurn, Model Z-1022

2.14 WALL-MOUNTED HOSE RACKS

A. The Contractor shall provide wall-mounted hose racks at the indicated locations.

B. Racks shall be of welded steel construction, minimum 8 gauge sheet steel, hot-dip galvanized after fabrication, and shall have a capacity to hold 100 ft 30.5 m of the indicated hose.

C. Racks located in the open shall be supported from two 2-in 50.8 mm by 2-in 50.8 mm by ¼-in 6.4 mm galvanized steel angle posts set in a concrete base or as indicated.

2.15 HOSES AND NOZZLES

A. The Contractor shall furnish the following lengths of hose:

1. Single lengths of 75 ft long, ¾-in hose.

a. Each length of hose shall be provided with male and female connectors and a nozzle.

b. Hoses shall be fabricated from seamless extruded rubber designed for a working pressure of at least 300 psig and shall be suitable for industrial applications.

c. Hoses shall be oil resistant reinforced to provide kink resistance.

d. Hoses shall be provided with brass threaded fittings, for hose bib and nozzle connection.

e. Temperature range is -20 deg F to 180 deg F.

2. Hoses Manufacturers, or Equal

a. Flexicraft, Model RM1

B. Nozzles:

1. Nozzles shall be capable of complete shut-off and shall produce a solid straight stream and up to a 90 deg conical fog.

2. Nozzle material shall be polished brass.

3. Nozzles shall be provided with rubber bumpers.

2.16 BACKFLOW PREVENTER

A. Provide reduced pressure backflow prevention units where indicated.

B. The valve shall be designed to be installed either vertically or horizontally.

C. The units shall be of bronze body construction, with celcon check seats and stainless steel relief valve seats, shafts, and bolts.

D. The units shall be provided with tight-seating check valve and relief assemblies, and bronze bodies with non-rising stem ball valve test cocks.

E. The units shall be Watts Regulator Co., No. LF909 Series, or Engineer approved equal.

F. Installation shall meet local code requirements.

G. Nozzle Manufacturers, or Equal

1. W.D. Allen Mfg. Co.
2. Fire-End and Croker Corp.
3. Halprin Supply Co.
4. Western Fire Equipment Coatts

2.17 NATURAL GAS SERVICE AND INSTALLATION

A. General

1. The Contractor shall provide the natural gas system and valving as indicated.

2. The Contractor shall pay any fees or charges levied by the Gas Company for installation or inspection.

B. Gas Piping

1. Gas piping shall be installed in strict conformance with applicable local or state regulations and the indicated requirements.

2. Black Steel Piping

a. Gas piping shall consist of black steel, Schedule 40, ASTM A53. Fittings 2 ½-in and smaller shall be Malleable iron, ASME B16.3, Banded, Black, 150 PSI. Fittings 3-in and larger shall be steel ASME B16.9, butt welded.

b. Joints for exposed piping shall be of the screwed type, with an adequate number of unions to facilitate removing of equipment and dismantling of piping for cleaning and inspection.

c. Joint compounds on steel pipe shall be rated for natural gas service, shall be resistant to the action of gas, shall be non-hardening, and shall be used sparingly on the male threads only.

C. Valves

1. Valves shall be used in accordance with the rating and service recommendations of the manufacturer.

2. Valves shall conform to the requirements of ANSI B31.8.

3. Full-opening non-lubricated plug valves shall be used in sizes larger than 2-in or for pressures greater than 0.5 psig.

4. No unions or valves shall be installed on pipe lines that will be concealed in partitions, ceilings, or the like.

5. Every union or valve shall be readily accessible for inspection and repair.

6. A plug valve shall be provided at each piece of equipment the gas system serves.

2.18 PAINTING

A. Ferrous metal, except finished, galvanized, and machined surfaces, shall have surfaces prepared and primed in the shop in accordance with the requirements of Section 09 91 00 – Paintings and Protective Coatings.

B. Prime colors shall be compatible with finish coats that are applied in the field.

C. Self-contained units such as wall-mounted hose racks shall be supplied with factory-applied finish coats of baked enamel.

D. Field painting shall comply with the requirements of Section 09 91 00 – Paintings and Protective Coatings.

PART 3 EXECUTION

3.1 PREPARATION

A. The Contractor shall coordinate the roughing-in process with provisions for wall and floor sleeves, pipe inserts, and cutting of roof and floor penetrations, such that drain lines will have the required invert elevations and slopes.

3.2 OPENINGS

A. New Construction

1. The Contractor shall provide necessary openings in walls, floors, and roofs for the passage of piping and plumbing equipment within and into the building.

2. Openings shall be as indicated or as required to provide passage for the plumbing Work.

3.3 INSTALLATION AND APPLICATION

A. The Contractor shall provide plumbing specialties in accordance with manufacturer's printed instructions.

B. Pipe shall be arranged in a neat and orderly manner to occupy the minimum amount of space and so that the pipe will not obstruct passageways and movement of building occupants or interfere with normal operation and maintenance of any equipment.

C. Pipe shall be carefully placed and properly sloped and shall be neatly and firmly supported by hangers or supports.

D. Piping in buildings shall be as close to the ceilings or walls as possible unless indicated otherwise.

E. Joints

1. Screwed joints shall be made with joint compound and be tight and leak-proof.

2. A sufficient number of brass-to-ferrous metal seat unions shall be placed in lines such that any pipe, valve, or piece of equipment may be easily disconnected.

F. Drainage and Sanitary Lines

1. Drainage and sanitary lines shall be properly run, trapped, and vented in order to conform to Code requirements.

2. Changes in direction shall be made with "Y" branch fittings and shall be of the same size as the pipe.

3. Changes in pipe size shall be made with reducing fittings.

4. The minimum depth of cover shall be 3 ft.

G. Horizontal soil, drain, and waste pipes shall be provided with a slope of at least ¼-in per foot, unless indicated otherwise.

H. Floor drains and cleanouts shall be installed such that the tops of the drains are flush with the finished floor.

I. Plug each natural gas outlet, including valves, with a threaded plug or cap immediately after installation, and retain the plugs until continuing piping or equipment connections are completed.

J. Joints in PE pipe shall be installed such that the longitudinal pull out resistance of each joint is at least equal to the tensile strength of the pipe.

3.4 EQUIPMENT DAMAGE AND REMOVAL

A. The Contractor's operations shall be carried out in such a manner as to guard against damage to those portions of the structure and equipment that are to remain in the finished Work.

B. Any damage caused by the Contractor or Subcontractor through their operations shall be repaired to the satisfaction of the Engineer.

3.5 TESTING

A. The Contractor shall perform such tests as are required by local ordinances and Codes in the presence of a local governing authority inspector to show that piping is tight, leak-free, and otherwise satisfactory, and shall also perform such tests as the Engineer may direct to ensure that fixtures and equipment operate properly.

B. The Contractor shall pay the costs to perform such tests and the costs of making changes or repairs until the Work is acceptable to the governing authorities.

C. Gas Piping Testing and Purging

1. Before the gas piping system is accepted, a test for tightness shall be performed and witnessed by the Engineer.

2. The system shall be subjected to a test pressure of at least 1.5 times the maximum operating pressure, but never less than 3 psig.

3. Air or an inert gas such as carbon dioxide, or nitrogen, shall be used as the pressurizing medium.

4. Under no circumstances shall oxygen or natural gas be used to test for tightness or to locate leaks.

5. The system shall hold pressure after disconnecting the pressure source for a period of at least 30 minutes without showing any drop in pressure after the test gas in the pipe has been given time to come to equilibrium at the ambient temperature.

6. Leaks shall be located by approved leak detectors, or by a soap and water solution, while the system is under pressure.

7. Purging

   a. After pressure testing, piping shall be fully purged with an inert gas inserted from the location most distant from the point of entry of the natural gas.

   b. Each major branch line shall be similarly purged from its far end.

   c. Purging shall be performed only by personnel experienced in this particular operation.

8. Repair or replace defective piping, and retest.

D. Potable Water and Drainage Piping Pressure Testing

1. Demonstrate to an Owner witness that the piping passes the following pressure tests before it is insulated or covered by walls or ceilings. Test piping after all fittings and valves for that portion of the piping have been installed.

2. All pressure testing shall be witnessed and documented with results approved and signed off by an Owner representative.

3. Repair leaks discovered during pressure testing. Retest failed sections of piping to demonstrate satisfactory results.

4. Potable Water Testing: Upon completion of a section or of the entire hot and cold water supply system, it shall be tested and proved tight under a water pressure not less than one and half time of the working pressure under which it is to be used, but not less than 125 psi. The water used for tests shall be obtained from a potable source of sup- ply. The piping shall withstand the test without leaking for a period of not less than 15 minutes.

5. Drainage Water Testing: The drainage, and venting systems shall be tested with water. The water test shall be applied to the drainage and vent systems either in its entirety or in

sections. Where the test is applied to the entire system, openings in the piping shall be tightly closed, except the highest opening, and the system filled with water to point of overflow. Where the system is tested in sections, each opening shall be tightly plugged, except the highest opening of the section under test, and each section shall be filled with water, but no section shall be tested with less than a 10 ft head of water. In testing successive sections, not less than the upper 10 ft of the next preceding section shall be tested, so that no joint or pipe in the building (except the uppermost 10 ft of the system) shall have been submitted to a test of less than a 10 ft head of water. The water shall be kept in the system, or in the portion under test, for not less than 15 minutes before inspection starts. The system shall then be tight at all points.

3.6 DISINFECTION

A. The line shall then be filled with water and maintained under not less than 10 psig pressure, for not less than 48 hours, during which period each valve on the line shall be opened and closed several times, after which it shall be flushed clean and then tested by the Owner.

B. After potable water supply lines are successfully pressure tested, they shall be disinfected by introducing an HTH solution, liquid chlorine, or chlorine solution of sufficient strength.

C. Potable water systems shall be purged of deleterious matter and disinfected prior to utilization. The method to be followed shall be that prescribed by the health authority or water purveyor having jurisdiction or, in the absence of a prescribed method, the procedure described in either AWWA C651 or AWWA C652, or as described in this section.

1. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.

2. The system or part thereof shall be filled with a water/chlorine solution containing not less than 50 parts per million (0.0080 oz./gal) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing not less than 200 parts per million (0.032 oz./gal) of chlorine and allowed to stand for 3 hours.

3. Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.

4. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.

D. This procedure shall be repeated as often as necessary until the line is pronounced safe for use by the Owner.

E. No cross-connection between the water main and any pipe not yet disinfected will be permitted.

END OF SECTION

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SECTION 22 30 00 – PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall provide plumbing fixtures and plumbing equipment as indicated, complete with water, gas and electric connections and hook-ups, for a complete and operable installation as indicated in accordance with the requirements of the Contract Documents.

B. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop Drawings

1. Certified pump curves for each pump

C. O&M Data

1. Submittals shall include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Reference Specifications

01 33 00	Submittal Procedures
01 33 17	Structural Design, Support and Anchorage
26 05 10	Low-Voltage Electrical Motors

B. Reference Standards

American National Standards Institute (ANSI)	
ANSI Z21.10.3	(2019) Gas-Fired Water Heaters Vol.III, Storage Water Heaters with Input Ratings Above 75,000 Btu/hr, Circulating and Instantaneous
American Petroleum Institute (API)	
American Society of Mechanical Engineers (ASME)	
API-ASME Code	Unfired Pressure Vessels for Petroleum Liquids and Gases
American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)	
ASHRAE 93-1986	Methods of Testing to Determine the Thermal Performance of Solar Collectors
Canadian Standards Association (CSA)	
International Electrical Commission (IEC)	

International Energy Conservation Code (IECC)	
IECC 2006	International Energy Conservation Code 2006
Solar Rating and Certification Corporation (SRCC)	
SRCC OG-300	(2015) Solar Thermal System Certification Program
Underwriters Laboratories (UL)	
UL 508	(2018; Reprint Jul 2021) UL Standard for Safety Industrial Control Equipment

PART 2 PRODUCTS

2.1 GENERAL

A. Plumbing piping, fixtures, specialties, equipment, and appurtenances shall be new, first-quality products manufactured for the intended usage.

B. Materials, capacities, features, finishes, and manufacturers shall be as indicated and shall be compatible with elements of the Work to which they relate or connect.

C. Any pipe, plumbing fitting or fixture, solder, or flux used in the installation or repair of any public water system or any plumbing in a facility providing water for human consumption, shall be "lead free" except when necessary for the repair of leaded joints of cast iron pipes.

1. Lead free is defined as not more than 0.2 percent lead when used with respect to solder and flux, not more than 0.25 percent in the wetted surface material of pipes, pipe fittings, plumbing fittings and fixtures.

2.2 GAS WATER HEATERS

A. General

1. Provide gas water heaters as indicated, complete with:

a. Gas, cold water, and hot water connections
b. Drain valve, ¾-in, piped to drain
c. Minimum ¾-in temperature and pressure relief valve, piped to floor drain
d. Aquastat
e. 4" PVC intake air connection
f. 1 ½" water inlet connection
g. ¾" recirculation return connection
h. 1 ½" natural gas connection
i. Power direct venting with 4" PVC pipe connection
j. Direct spark ignition
k. Leak detection and warning

B. Tank Components

1. Welded steel construction, with a working pressure of not less than 150 psig

2. Glass lining

3. Magnesium anode

4. Minimum 1-in thick fiberglass insulation

5. Galvanized steel drip pan and seismic trap supports, per Section 01 33 17– Structural Design, Support and Anchorage

6. Enameled steel jacket

C. The gas burner shall be suitable for natural gas and shall be provided with 100 percent safety shut-off, easily accessible non-linting pilot, and fingertip temperature selection.

D. The tank shall be protected against premature failure as follows:

1. Electrolytic Corrosion Protection: Provide protection against electrolytic corrosion by providing a conveniently located, easily replaceable magnesium anode rod.

2. Overheating Protection:

a. Provide protection against overheating caused by the build-up of scale, film and other sediment, by providing an annular ring which fits inside the tank at the base.

b. The ring shall be equipped with a group of calibrated jets, properly positioned such that they will direct the inlet water in such a way that particles of sand, silt, or scale present in the water shall be burned and agitated, kept in suspension, and carried out of the water heater on that or on succeeding water draws.

E. Flue

1. A flue shall be provided from a draft diverter to a location above the roof in accordance with applicable codes.

2. The flue termination shall be complete with supports, roof flashing, and weather cap.

3. The flue shall be of double walled, stainless steel.

F. Controls

1. Adaptive gas control

2. Intelligent control system with touch display and iCOMM connectivity

G. Gas water heaters shall meet the following requirements:

Water heater identification	WH-01
Location	Mechanical Room
Tank capacity, gallons	119
Heater input, BTU/hr	251,000
Heater output, BTU/hr	250,000
Thermal efficiency	97%
Recovery rate, gallons/hr at 100 deg F rise	289

H. Manufacturers or Equal

1. A.O. Smith Model BTH-251(A)
2. Rudd;

2.3 EMERGENCY SHOWER THERMOSTATIC MIXING VALVE

A. General

1. Provide a thermostatic mixing valve to mix hot and cold water to supply tempered water.

2. Mixing valve shall supply tempered water to one or more emergency drench showers and eyewash fixtures and shall be capable of supplying a flow rate up to 40 gpm.

B. The thermostatic mixing valve shall meet the following requirements:

1. Provide 2 separate thermostatic mixing elements and 3 outlet temperature gauges.

2. The mixing valve shall be constructed of bronze, brass, copper, and stainless steel.

3. Tempered Water

a. Twin thermostatic mixing elements shall respond independently to changes in incoming hot and cold water temperatures in order to maintain outlet temperatures to within plus or minus 5 deg F.

b. Varying conditions can cause a maximum change in hot water or cold water temperatures of 30 deg F, and a 50 percent drop in inlet supply pressure.

c. Hot and cold inlet pressures shall be equal.

d. The outlet temperature factory setting shall be 80 deg F.

4. Fail-Safe Backup

a. Provide liquid thermal thermostats with tamper-resistant control adjustment.

b. The system shall shut off incoming hot water if the cold water supply fails.

c. Provide redundant thermostatic elements in order to provide tempering even if one element were to fail.

d. If the hot water supply is interrupted or the thermostatic elements fail, the valve shall provide cold water flow via a bypass loop.

5. Inlet Pressure and Temperature

Maximum inlet pressure, psig	125
Maximum inlet temperature, deg F	140
Minimum inlet temperature, deg F	60
Recommended inlet temperature, deg F	80

C. Manufacturers, or Equal

1. Haws Model No. 9202

2.4 CIRCULATING PUMPS (DOMESTIC HOT WATER)

A. General

1. Type: Variable Speed ECM Smart Circulator
2. Material: Stainless steel construction for durability and corrosion resistance.
3. Applications: Suitable for potable water, heating, and cooling systems.
4. Motor Type:
    a. Electronically Commutated Motor (ECM) for energy efficiency and variable speed control.
    b. The pumps shall be directly connected to the drive motor by means of a flexible coupling to eliminate vibration.
    c. The motor shall not overload at any point throughout the head and capacity range of the pump.
    d. Pump and motor shall be suitable for continuous duty while pumping clear hot water up to 220 deg F 104.4 deg C.
5. Power Supply: Typically operates on standard voltage (check specific model for details).
6. Flow Rate: Designed to optimize flow rates based on system demand, enhancing energy savings.
7. Control Features:
    a. CircGuard™: Integrated system protection.
    b. Wireless Connectivity
    c. Temperature Control: T/ΔT temperature control for efficient operation.
    d. eAdapt Autolearn: Automatically adjusts to system needs for optimal performance.
    e. Noise Level: Operates quietly with minimal vibration, ensuring comfort in residential and commercial settings.
    f. Installation: Compact design for easy installation in tight spaces; includes insulation shell and check valve.

B. Additional Features

1. Automatic Air Purge: Removes trapped air in the pump for improved efficiency.

2. Energy Efficiency: Meets Energy Star and UL standards, reducing energy consumption and operating costs.

3. Digital Display: Provides real-time information and control options for users.

4. The Ecocirc 20-18 circulator is designed to enhance the performance of plumbing systems while ensuring energy efficiency and user-friendly operation. For more detailed specifications, you may refer to the product manual or installation guide

C. Provide pressure taps on both inlet and outlet of pump.

D. The pumps shall meet the following requirements:

Pump identification number	CP-01
Location	Mechanical Room
Flow rate, gpm	5
Total head, feet	6
Motor Watts	6
Motor speed, RPM	0-70
Motor voltage / phase / Hertz	115/1/60

E. Manufacturers, or Equal

1. Bell and Gossett, Ecocirc +20-18
2. Taco, Inc.
3. A.O. Smith

2.5 EXPANSION/COMPRESSION TANKS AND ACCESSORIES

A. General

1. Provide expansion/compression tanks and accessories as indicated.

2. The tanks shall be hydrostatically tested for a working pressure of 125 psig and shall be ASME rated.

3. The tanks shall be provided with a ½-in 12.7 mm water gauge glass, a ½-in 12.7 m tank drain, and a ¾-in 19.1 mm tank fitting.

4. The tanks shall be provided with hangers and supports.

5. The tanks shall be completely insulated as recommended by the tank manufacturer.

6. The sizes and capacities of the tanks shall be as indicated.

B. Manufacturers or Equal

1. Expansion/Compression Tanks

a. Bell and Gossett
b. Taco
c. Thrush

2. Tank Fitting

    a. Bell and Gossett HFT Series
    b. Taco
    c. Thrush
    d. Tank fitting shall be sized to fit the tank and by the same manufacturer of the tank.

2.6 PRESSURE RELIEF VALVE

A. General

B. Pressure relief valves shall have a relieving capacity and pressure as required to permit a rise in pressure within the vessel or piping not more than 25 percent above the working pressure when the valve is relieving.

C. The valve shall consist of a semi-steel body with stainless steel trim suitable for tight shutoff.

D. The valve shall be equipped with a manual lift lever for testing and shall be field adjustable to a minimum of plus or minus 10 percent of the normal setting.

E. The valve shall be constructed to the requirements of API-ASME Code for Unfired Pressure Vessels for Petroleum Liquids and Gases and stamped accordingly.

F. Manufacturers or Equal

    a. Lunkenheimer Figure 629

PART 3 EXECUTION

3.1 WATER HEATER INSTALLATION

A. The Contractor shall install the water heaters in accordance with the manufacturer's printed instructions.

B. The Work shall be coordinated with plumbing piping and related gas venting Work.

C. The Contractor shall provide steel pipe supports for tanks, independent of building structural framing members.

D. Tanks shall be cleaned and flushed prior to delivery at Project Site after installation but prior to Startup.

E. Equipment openings shall be sealed until piping connections are made.

END OF SECTION

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SECTION 22 40 00 – PLUMBING FIXTURES

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall provide plumbing fixtures, complete and operable, as indicated in accordance with the Contract Documents.

B. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop Drawings

1. Show material type, material thickness, sinks, counters, splashes, drawers, shelves, legs, frame, supports, and anchors or fasteners for the counter sink unit.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Reference Specifications

01 33 00	Submittal Procedures
07 92 13	Elastomeric Joint Sealants

B. Reference Standards

American Bureau of Shipping (ABS)	
Americans with Disabilities Act (ADA)	
American National Standards Institute (ANSI)	
NSF/ANSI 61	(2020) Drinking Water System Components – Health Effects
ANSI A112.6.1	Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
ANSI A112.18.1	Plumbing Fixture Fittings
ANSI A112.18.1M	Plumbing Fixture Fittings
ANSI A112.19.1	Enameled Cast Iron Plumbing Fixtures
ANSI A112.19.2	(1973) Vitreous China Plumbing Fixtures
ANSI A112.19.4	(1994) Porcelain Enameled Formed Steel Plumbing Fixtures (with Supplement and Errata)
ANSI A112.19.5	Trim for Water Closet Bowls, Tanks and Urinals
ANSI A117.1	(2009) Accessible and Usable Buildings and Facilities
ANSI Z124.2	(1995) Plastic Shower Units
ANSI Z358.1	(2014) American National Standard for Emergency Eyewash and Shower Equipment

American Society of Mechanical Engineers (ASME)	
ASME A112.19.2	(2018) Ceramic Plumbing Fixtures
ASME A112.6.1M	(1997) Floor-Affixed Supports for the Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.6.2	Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
American Society of Sanitary Engineering (ASSE)	
ASSE 1070	(2015) Performance Requirements for Pressurized Flushing Devices for Plumbing Fixtures
ASSE 1071	(2012) Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment
International Building Code (IBC)	
International Code Council (ICC)	
NSF International (NSF)	

PART 2 PRODUCTS

2.1 GENERAL

A. Reference Standards: Products in this section shall be built, tested, and installed in compliance with the following quality assurance standards; latest editions, unless noted otherwise.

International Plumbing Code with local amendments.	
NSF/ANSI-61	G Drinking Water System Components - Health Effects
ANSI A112.6.1	Supports for Off-the-Floor Plumbing Fixtures for Public Use
ANSI A112.18.1	Finished and Rough Brass Plumbing Fixture Fittings
ANSI A112.19.1	Enameled Cast Iron Plumbing Fixtures
ANSI A112.19.2	Vitreous China Plumbing Fixtures
ANSI A112.19.4	Porcelain Enameled Formed Steel Plumbing Fixtures
ANSI A112.19.5	Trim for Water-Closet Bowls, Tanks, and Urinals
ANSI Z124.2	Gel-Coated Glass-Fiber Reinforced Polyester Resin Shower Receptor and Shower Stall Units
ANSI Z358.1	Emergency Eye Wash and Shower Equipment
ASSE 1071	Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment
ARI 1010	Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers

B. Plumbing piping, fixtures, specialties, and equipment shall be:

1. Of the latest design.
2. All brass must be of the best quality. Lightweight goods will not be accepted.
3. Manufactured for the intended usage.
4. Compatible with elements of related or connected Work.

C. Design Features

1. Plumbing fixtures shall be provided without flaws, and with a white finish unless otherwise indicated.

2. Exposed brass, faucets, valves, wastes, traps, piping, and escutcheons shall be chrome plated. Faucets shall be free of tool marks or other flaws.

3. "P" traps on lavatories and sinks shall be cast brass with cleanouts.

4. Each fixture shall be provided with individual stops and shall be anchored firmly to the building wall or floor.

5. Softeners, water heaters, and lab equipment shall be provided with drains and isolating valves on each side.

6. For the purpose of establishing type and class of fixtures and faucets required, the following manufactures and models are indicated: Fixture manufacturers and model of equal features and quality may be submitted for approval.

7. Refer to Architectural Drawings for mounting height and exact location of all plumbing fixtures. Handicapped fixtures shall be installed to meet the latest ADA requirements.

D. Water closets, valves, fixtures, and hardware shall be approved by local governing authorities as low-flow items.

E. Floor-mounted and tank-type water closets indicated (by "HC") for handicapped persons or located within a toilet stall indicated for handicapped persons shall conform to ADA requirements.

F. Any pipe, plumbing fitting or fixture, solder, or flux used in the installation or repair of any public water system or any plumbing in a facility providing water for human consumption, shall be “lead free” except when necessary for the repair of leaded joints of cast iron pipes.

1. Lead free means not more than 0.2 percent lead when used with respect to solder and flux, not more than 8 percent when used with respect to pipes and pipe fittings, and not more than 4 percent with respect to plumbing fixtures.

G. Pre-wrapped Insulation

1. Insulate exposed lavatories drain piping, hot/cold stops and supplies in accordance with the requirements of ADA and the International Building Code (IBC).

2. The pre-wrapped insulation shall be easily removable, bacteria resistant, molded to piping and fixture configurations, closed cell vinyl assembles.

3. Fasteners shall be corrosion-resistant and reusable.

4. Pre-wrapped insulation shall be Lav Guard as manufactured by Truebro, Inc., Pro-Wrap as manufactured by McGuire Manufacturing Co., or equal.

2.2 FIXTURE SCHEDULE

Drawing Callout	Fixture Type	Description
WC-1	Water Closet (ADA complaint floor-mounted)	Water closet, with elongated floor mounted siphon jet bowl; designed to flush at both 1.1 gpf, 1.28 gpf or 1.6 gpf, white solid plastic open front seat; self-sustaining hinges; and automatic flush valve and escutcheons (with 1-in water supply connection) 16 5/8-in rim height, 12-in rough-in. Accepted manufacture: Kohler K-96057, Highcliff Ultra
LAV-1	Lavatory (ADA compliant wall-hung)	Lavatory basin, vitreous China, wall-mount, with overflow, drilled for concealed, single-hole, size 20-in x 27-in, complete with wall carrier; chrome-plated combination supply with angle stops and pop-up fitting with aerator; manual faucet with thermostatic mixing valve, and a 1 ¼-in, chrome-plated "P" trap with chrome-plated escutcheon. Code Standards: ASME A112.19.2/CSA B45.1 ADA ICC/ANSI A117.1 Acceptable manufacturer: Kohler, Model K-12638, Greenwich
SK-2	Double Compartment Sink	18-gauge stainless steel countertop, two-compartment sink with back ledge and clamps, rounded corners, overall size 43-in by 22-in by 10 1/8-in deep; with stainless steel basket strainers; 1 ½-in brass "P" trap; and polished chrome-plate cast brass faucet body, 8-in fixed centers hot and cold water inlet, single control kitchen faucet, a ceramic disc cartridges and a temperature limit stop, 10-in cast swing spout with 2.2 gpm aerator. Faucet shall be Zurn Z812A4-XL or approved equal. Acceptable manufacture: Elkay DLR-432210 or approved equal.
SK-1	Mop Sink Basin (24x24)	One-piece precast terrazzo mop service basin. Floor-mounted, size 24-in x 24-in x12-in, furnished with stainless steel curb caps, service sink faucet ¼ turn cartridge stems with wrist blade handles, 8-in centers with vacuum breaker, ¾-in male hose thread and pail hook Chicago Faucet 540-LD897SWXF317CP or approved equal, complete with hose, and hose bracket., stainless steel wall guards, aluminum bumper guard. Accepted manufacturer: Fiat TSB-100 or approved equal.
ES-1	Emergency Shower (with eye-face wash and independent operated valves)	The emergency drench showers, not subject to freezing, with shower head, self-closing manual valve, handle, eyewash with stainless steel bowl and galvanized drain, emergency alarm light, buzzer, and flow switch with two dry contacts, and 1 ¼-in supply. HAWS Model No. 8317, Bradley Corp. Model S19-310 with ASSE 1071 certified Thermostatic mixing valve, or equal. Emergency alarm system shall be HAWS Model 9001, or equal, and shall include a flow switch activated intermittent audible alarm rated at 90db @ 10 ft, and 100 W green flashing area light.

Drawing Callout	Fixture Type	Description
DF-1	Dual Height Drinking Fountain	Dual-height, recessed wall-mounted, barrier free, stainless steel electric water cooler furnished with push button, bubbler, integral chiller with a capacity of 8.0 GPH of 50 deg F. water @ 90 deg F. ambient. Haws H1011.8, or equal;120-volt, single phase, 60 Hz.

2.3 WALL MOUNTED LAVATORIES

A. General

1. Vitreous China Wall Hung Lavatory: ASME A112.19.2; vitreous China wall mount lavatory with overflow, with 4-in high back, 21-in x 18-in with drillings on 4-in centers.

2. Complete with concealed arm carrier and wall hanger.

3. Acceptable manufacturers:

   a. Kohler, Model K-2032, Greenwich.
   b. American Standard
   c. Crane

B. Sensor Activated Faucet (1.0 gpf)

1. Chrome plated cast brass sensor faucet with motorized actuator, an integral infrared convergence-type proximity sensor with thirty second time out feature. Faucet shall be ADA compliant.

2. Furnish with 0.5 gpm aerator (complying with ANSI A112.18.1M Standard for flow).

3. Furnish with 4-in centers cover plate.

4. Complete with hardwire 7.6 VDC power converter. Each power converter can accommodate up to eight valves., Zurn P6000-HW6 or equal.

   a. Acceptable manufacturers:
   b. Zurn, Model Z6913-F-CP4-XL
   c. Meon
   d. Sloan
   e. Sloan

C. ACCESSORIES

1. Chrome plated 17-gage brass P-trap with clean-out plug and arm with escutcheon.
2. Chrome plated rigid supplies to fixtures with supply stops, reducers, and escutcheons.
3. Offset waste with perforated open strainer.
4. Exposed piping, waste and supply, shall be insulated and offset to meet ADA compliance.

D. Thermostatic mixing valve shall conform to ASSE 1070 and designed to be installed at the point of use. Zurn Model ZW1070XL or equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Each fixture shall be installed with a trap that is easily removable for servicing and cleaning and vented in accordance with the applicable plumbing code.

B. The Contractor shall provide chrome-plated rigid or flexible supplies to fixtures with angle stops, reducers, and escutcheons.

C. Components shall be installed level and plumb, and supplies and wastes shall be centered on or between the wall tiles.

D. Attachment

1. Fixtures shall be installed and secured in place with floor carriers and bolts.
2. Water closets shall be solidly attached to a floor or wall carrier with lag screws.
3. Lead flashing shall not be used to hold fixtures in place.

E. Sealant

1. Fixtures shall be sealed to wall and floor surfaces with sealant in accordance with the requirements of Section 07 92 13 – Elastomeric Joint Sealants.

2. Sealant color shall match the fixture.

F. Fixtures shall be mounted to the following heights above finished floor:

Water Closet		
Standard	15-in 380 mm	to top of bowl rim
Handicapped	17-19-in 430 - 480 mm	to top of seat
Lavatory		
Standard	31-in	to top of basin rim
Handicapped	34-in, max 29-in, min	to top of basin rim clearance under or pullman option
Drinking Fountain		
Standard	40-in 1020 mm	mm to top of basin rim
Handicapped	36-in, max 27-in , min	to top of basin rim clearance under unit apron
Water Closet Flush Valves		
Standard	11-in	in. above bowl rim
Recessed	10-in	min. above bowl rim
Handicapped	44-in, max	in. above finished floor to flush valve control and easily accessible
Emergency Eyewash		
Standard	38-in	to receptor rim
Handicapped	34-in, max 27-in	to receptor rim to spray head

Emergency Shower		
Standard	84-in	to bottom of head
Handicapped	48-in, max	to pull handle

3.2 ADJUSTING AND CLEANING

A. Stops or valves shall be adjusted for the intended water flow rate to fixtures without splashing, noise, or overflow.

B. At completion, the Contractor shall clean plumbing fixtures and equipment.

END OF SECTION

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SECTION 23 05 00 – COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall provide heating, ventilating, and air conditioning systems and associated equipment complete with supports, mounting frames, ventilators, ductwork, piping, louvers, panels, filters, grilles, electric drive units and controls, mechanical equipment, electrical work, appurtenances, testing, and balancing, as indicated in accordance with the Contract Documents.

B. The equipment shall be installed ready for operation.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Reference Specifications

01 33 00	Submittal Procedures
01 33 17	Structural Design, Support and Anchorage
01 42 19	Reference Standards
07 42 00	Metal Roof and Wall Panels
09 96 00	High-Performance Coatings
23 07 00	HVAC Insulation
23 07 13	Duct Insulation
23 07 19	HVAC Piping Insulation
23 23 00	Refrigerant Piping
26 00 10	Electrical General Requirements
26 05 10	Low-Voltage Electric Motors
26 27 16	Electrical Cabinets and Enclosures
26 05 20	Low-Voltage Electrical Power and Control Conductors and Cables
26 05 33	Raceway and Boxes for Electrical Systems
26 05 43	Underground Ducts and Raceways for Electrical Systems
26 24 19	Motor Control Centers
26 29 13.13	Across-the-Line Motor Controllers
40 05 07	Hangers and Supports for Process Piping
40 05 24	Steel Process Pipe

B. Reference Standards

Air Movement and Control Association International, Inc. (AMCA)	
American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)	
ASHRAE Standard 52-76/ASHRAE 52.1-1992 Standard	Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter
American Society of Civil Engineers (ASCE)	
ASCE 7-10	(2010; Errata 2011; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

American Society of Mechanical Engineers (ASME)	
Institute of Electrical and Electronics Engineers (IEEE)	
National Electrical Manufacturers Association (NEMA)	
National Fire Protection Association (NFPA)	
NFPA 72	(2022) National Fire Alarm and Signaling Code
NFPA 90A	(2021) Standard for the Installation of Air Conditioning and Ventilating Systems
Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)	
Underwriters Laboratories (UL)	
UL 900	(2015) Standard for Air Filter Units

1.3 CONTRACTOR SUBMITTALS

A. Shop Drawings

1. Submit complete shop drawings and certificates, test reports, affidavits of compliance, for all equipment, ductwork and piping systems, in accordance with the requirements in Section 01 33 00 – Submittal Procedures, and as indicated in the individual equipment, piping or ductwork Sections.

2. Construction Drawings

a. The HVAC Drawings define the general layout, configuration, routing, size and the general intent of the design. and are not fabrication drawings.

b. The ductwork dimensions provided on the design drawings represent a free area and they are clear inside dimensions. The contractor shall be responsible to account for the loss of free area due acoustical lining, or any internal obstructions, and oversize the ductwork to provide the same free area as the one shown on the design drawings.

c. It shall be the Contactor's responsibility to develop the Shop Drawings required for the construction of the HVAC system.

3. The Shop Drawings shall include all necessary dimensions and details regarding equipment, pipe and ductwork joints, fittings, valves, appurtenances, design calculations, and material lists.

4. The submittals shall include detailed layout, spool, or fabrication drawings which shall show all fittings, and supports as necessary to accommodate the equipment as a complete and functional system.

B. Equipment Numbers

1. Equipment is identified by assigned numbers for reference and location purposes in the Contract Documents.

2. Indicate the appropriate equipment numbers on the Shop Drawings and other submittals.

C. Furnish certified fan curves for each fan.

1.4 WARRANTY

A. Air conditioners, heaters, fans, ventilators, grilles, and the like, that are provided by the Contractor shall carry the manufacturer’s standard warranty.

B. Warranties shall be furnished to the Engineer upon final acceptance of the completed systems by the Owner.

C. Refrigerant compressors shall carry a manufacturer's 5-year warranty.

D. Control System

1. The temperature and equipment control system shall be warranted free from defects in workmanship and material under normal use and service for a period of one year after acceptance by the Engineer.

2. Equipment that proves to be defective in workmanship or material during the warranty period shall be adjusted, repaired, or replaced by the automatic control manufacturer as part of the Contract.

PART 2 PRODUCTS

2.1 GENERAL

A. Quality

1. Mechanisms and other parts shall be amply proportioned for the stresses which may occur during operation and for any other stresses which may occur during fabrication and erection.

2. Individual parts furnished which are alike in all units shall be alike in workmanship, design, and materials, and shall be of the manufacturer's top-line, industrial-commercial grade.

B. Supports

1. Equipment and appurtenances shall be firmly anchored or connected to supporting members.

2. Equipment shall be supported on restrained spring-type vibration isolators.

3. Support as required for the proper installation of the equipment, but not forming an integral part of the building structure, shall be provided unless otherwise indicated.

C. Noise and Vibration Control

1. The system shall be free of objectionable vibrations and noise.

2. Provide flexible connections in ducts and piping connections to fans, compressors, and other vibrating equipment.

D. Seismic Restraints

1. Design the equipment, duct and piping supports and restraints for static, dynamic, and seismic loads in Zone 4 in accordance with the International Building Code.

2. Seismic restraints shall not induce stresses in the equipment, ductwork and piping caused by thermal expansion and contraction.

3. Comply with Section 01 33 17 – Structural Design Support and Anchorage.

2.2 MOTORS

A. Motors provided with the equipment shall conform to the latest IEEE and NEMA requirements for mechanical and electrical characteristics, including service factors.

B. Motors shall be in conformance with the requirements of Section 26 05 10 – Low-Voltage Electric Motors.

C. Each motor shall bear the manufacturer's nameplate with complete motor data.

D. Each motor shall be of ample size and construction to continuously carry the loads which might be imposed by the equipment throughout the full range of operation of the equipment.

E. The maximum motor loading shall be less than or equal to the nameplate horsepower rating, exclusive of the service factor.

2.3 ELECTRICAL WORK

A. The Work of this section shall include:

1. Provide controls, sensors and control panels relating to the HVAC systems, including starters, thermostats, motorized dampers, louver operators and other equipment as indicated.

2. Provide control wiring of 120-volt and less as indicated in this Section and in conformance the requirements of Division 26 – Electrical and Division 40 – Instrumentation and Control.

B. The Work of Division 26 shall include:

1. Provide local power disconnects, where required.

2. Provide circuit breakers, starters in motor control centers, and 120-, 208-, 240- and 480-volt power feeders from the starters and circuit breakers to the HVAC equipment, as indicated.

C. Stand-alone starters shall be in accordance with the requirements of Section 26 29 13.13 - Across-the-Line Motor Controllers.

D. Starters in motor control centers shall be in accordance with the requirements of Section 26 24 19 - Motor Control Centers.

E. Enclosures shall be of the same NEMA class as the electrical equipment in the same area.

F. Starters shall be of the same manufacturer as the starters indicated under Section 26 29 13.13 – Across-the-Line Motor Controllers and 26 24 19 – Motor Control Centers.

G. Low-voltage control wiring shall be in accordance with the National Electric Code.

H. Control wiring for line voltage 120-volt and higher shall be in conformance with the requirements of Section 26 05 20 – Low-Voltage Electrical Power Conductors and Cables.

I. Control Panels shall be in conformance with the requirements of Section 26 27 16 - Electrical Cabinets and Enclosures.

J. Conduit shall be in conformance with the requirements of Section 26 05 33 – Raceway and Boxes for Electrical Systems and Section 26 05 43 – Underground Ducts and Raceways for Electrical Systems.

2.4 DUCT SMOKE DETECTORS

A. Products

1. Furnish and install all duct smoke detectors whether shown on the drawings or required by code. If the project includes an existing fire alarm panel all signals from the duct smoke detectors shall be transmitted to the existing fire alarm panel. If the project does not include an existing fire alarm panel, and a new fire alarm panel is not required for any other reason, signals from the duct smoke detectors shall be transmitted to the HVAC automatic temperature control panel.

2. Air Handling Units and Fans

a. Provide duct smoke detectors on both the intake and the discharge of air handling units, and fans as required by code.

b. The detector shall shut off the respective air handling unit or fan upon the detection of smoke.

3. Smoke detectors shall operate on the photoelectric principle and shall respond to a predetermined smoke density regardless of the rate of combustion, the distance between the detector and fire source, the combustible material, the temperature or velocity of the smoke, and whether the fire is in a confined or open area.

4. The detectors shall be designed to ignore invisible airborne particles or smoke densities that are below the factory-set alarm point.

5. The smoke detectors shall be capable of operating at a humidity range of 10 to 90 percent RH.

6. The smoke detectors shall operate from a 24-VDC power source, and shall be Simplex, 4098 Series, ADT; Pyrotronics; or equal.

B. Refer to the Temperature Controls Sequence of Operation on the Drawings for additional information regarding operation of the fire alarm system.

2.5 PIPE AND FITTINGS

A. Heating piping shall be Schedule 40 black steel pipe with screwed fittings.

B. Refrigerant piping shall be Type L hard temper copper with cast brass fittings.

C. Provide a drain at each low point in the piping system.

D. Copper and steel pipe and fittings shall be in conformance with the requirements of Section 23 23 00 – Refrigerant Piping and Section 40 05 24 – Steel Process Pipe, respectively.

E. Joints in refrigeration piping shall be made with silver solder.

2.6 PIPING AND DUCTWORK INSULATION

A. HVAC Pipe Insulation shall be in conformance with the requirements of Section 23 07 00 – HVAC Insulation.

B. HVAC Ductwork insulation shall be in conformance with the requirements of Section 23 07 00 – HVAC Insulation.

C. HVAC Refrigerant Pipe insulation shall be in conformance with the requirements of Section 23 23 00 – Refrigerant Piping.

2.7 WELDING

A. The welding of black steel or alloy pipe shall be carried out in strict accordance with AWS procedures and the codes and ordinance of the Village of Machesney Park and the State of Illinois pertaining to welded steel pipelines.

B. Welding shall be accomplished by means of the shielded electric arc process and performed by workers who are certified for this Work.

2.8 HANGERS AND SUPPORTS

A. Anchorage and bracing for all suspended ductwork and other distribution systems needs to be provided per 2022 Oregon Specialty Building Code/ASCE 7-10 Chapter 13

B. Provide all necessary hangers, supports, concrete inserts, anchors and guides for material and equipment to be installed.

C. No perforated strap hangers and no wire supports will be accepted.

D. Insulation Allowance

1. Hangers supporting insulated pipe shall be sized to fit the pipe plus the insulation.

2. The insulation at support points shall be provided with a metal shield in order to prevent damage to the insulation.

E. Anchors and guides shall be constructed of steel, in accordance with approved Shop Drawings, and as indicated.

F. Pipe hangers used to support uninsulated copper piping shall be copper plated.

G. Anchors

1. Anchorages shall be obtained by welding lugs onto the pipe and providing abutting surfaces against the lugs to restrict longitudinal movement.

2. Anchors shall be designed such that the pipe may be removed by removing bolts; no welding of pipe to the anchor will be accepted.

3. bolting materials shall be cadmium plated.

H. Guides shall be located not more than 20 ft from each expansion loop or joint.

I. Horizontal runs of pipe shall be provided with supports spaced such that the sag of the unsupported length will not create any pockets in the piping (weight of fluid included).

J. Pipe support lengths shall be in conformance with the requirements of Section 40 05 07 – Hangers and Supports for Process Piping.

K. Vertical Piping

1. Vertical piping shall be:

a. Supported at the base with fittings made for this purpose; or

b. Supported from the nearest horizontal member or floor with a riser extension pipe clamp.

2. Provide a riser extension clamp on each floor.

L. Hangers for ductwork and equipment shall be as indicated and in accordance with the guidelines of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

M. Inserts shall be galvanized.

2.9 PIPE SLEEVES

A. The Contractor shall examine the Drawings carefully for sleeves that are to be built into the construction and plan the Work accordingly, such that the sleeves are placed well in advance and care is taken with their location and support until encased.

B. Sleeves shall be fabricated from standard weight galvanized steel pipe for dry interior installations.

C. Sleeves for exterior or wet installations shall be fabricated from standard-weight ductile black steel, stainless steel, or standard-weight PVC for pipe temperatures below 120 deg F.

D. Sleeves shall be sized one pipe size larger than uninsulated piping and one pipe size larger than piping plus insulation for insulated pipe.

E. Locations

1. Where pipes pass through floors, sleeves shall extend 3-in above the finished floor.

2. Where pipes pass through walls, sleeves shall be flush with the wall.

F. Manufactured, Prefabricated Flues

1. Manufactured, Prefabricated flues shall be:

a. UL-listed

b. Used at temperatures not to exceed 1000 deg F under continuous operating conditions

c. Designed to be gas-tight to prevent leakage of combustion products into the building

d. Designed to compensate for flue gas-induced thermal expansions

2. The double-wall flue shall be provided with:

a. An inner gas-carrying pipe fabricated of Type 304 stainless steel

b. A nominal 1-in air space between the walls

c. An outer jacket constructed of aluminum-coated steel or Type 304 or Type 316 stainless steel, for additional corrosion protection in hostile environments

3. The flue duct shall be Selkirk Metalbestos Model PS, or equal.

2.10 MOTORIZED DAMPERS

A. General

1. Provide motorized opposed blade dampers as indicated.

2. Damper sizes and capacities shall be as indicated on the Drawings.

B. Design and Construction

1. The damper and frames shall be fabricated from aluminum with a minimum thickness of B&S 12-gauge.

2. The aluminum blades shall be provided with interlocking edges, with one center and two edge crimps, and brass bearings.

3. The frame shall be of welded channel construction and shall be provided with lugs and mounting brackets for damper operators.

4. The dampers shall be provided with felt or rubber seals at their edges to minimize air infiltration when closed.

C. Motors

1. Damper motors shall be electric, with necessary linkages for positioning the damper blades.

2. The motors shall be powered open and spring-closed, unless otherwise indicated.

2.11 BACKDRAFT OR GRAVITY DAMPERS

A. General

1. Provide backdraft dampers on the exhaust fans and ventilators where indicated.

2. Damper sizes and capacities shall be as indicated on the Drawings.

B. Design and Construction

1. The dampers shall be of the multi-blade type, with soft-seating gaskets for minimizing noise and air leakage when closed.

2. Blades shall be constructed of 16-gauge aluminum and shall be of an air foil design.

3. Frames shall be fabricated from 16-gauge extruded aluminum alloy.

4. The frames shall be totally out of the air stream and arranged for flange mounting.

5. The dampers shall be designed to operate at 0.05-in w.g. S.P., or less.

6. Blades shall be individually counterbalanced and shall be provided with non-ferrous pins turning in nylon bearings.

C. Damper Manufacturers, or Equal

1. Air Balance, Inc.
2. Air Dynamic
3. Ruskin, Model BD2A1

2.12 VOLUME, CONTROL DAMPERS (MANUAL AND MOTORIZED)

A. General

1. Provide volume control dampers in accessible locations in branch supply ducts and at each exhaust air opening, in order to properly regulate the volume of air delivered or withdrawn from each inlet and outlet, and as indicated.

2. Damper sizes and capacities shall be as indicated on the Drawings.

B. Construction

1. The volume dampers shall be of the opposed blade type.
2. The dampers shall be constructed of aluminum, of B & S 14-gauge thickness.
3. The dampers shall be suitably reinforced with sturdy control shafts.
4. Ductwork shall be reinforced to double thickness at damper shaft openings.

C. Air Extractor Type

1. The volume control dampers indicated to be of the air extractor type shall be constructed of stainless steel, of 20-gauge for frames and of 24-gauge thickness for blades.

D. No splitter dampers will be accepted.

E. Manual control dampers shall be provided with mechanisms for adjustment and locking into position after being set.

F. Motors

1. Damper motors shall be electric, with either modulating or 2-position control and necessary linkages.

G. The motors shall be powered open and spring-closed, unless otherwise indicated.

2.13 REGISTERS, GRILLES AND DIFFUSERS

A. General

1. Provide supply and return registers and grilles, and all supply diffusers as indicated.
2. The sizes, capacities, and deflection of each unit shall be as indicated on the Drawings.

B. The following schedule shall be followed as in the Contract drawings.

C. Registers, grilles and diffusers shall be constructed of aluminum.

D. The finish shall be a white baked-on enamel.

E. Accessory equipment shall be constructed of aluminum, or steel if aluminum is not available, and provided with a white baked-on enamel.

F. The proper border style shall be selected by the Contractor to suit the installation conditions.

G. Registers, grilles, and diffusers located in corrosive atmospheres, as indicated, shall be painted with a special protective coating in accordance with the requirements of Section 09 96 00 – High-Performance Coatings.

2.14 AIR FILTERS

A. The aluminum washable metal mesh filter shall be 2-in thick and shall consist of multiple layers of 20-gauge aluminum slit and expanded into mesh of differing densities with hundreds of baffle-like surfaces. Filter shall contain 5 layers of ¼-in and 5/8-in thick corrugated aluminum. Mesh media shall be contained within a .017-.019 one piece constructed roll formed aluminum frame. Frame shall come with drainage ports. Initial airflow resistance shall be 0.04-in w.g. initial resistance and 0.50-in w.g. recommended final resistance, and rated for maximum Temperature of 240 deg F.

1. Aluminum Washable Air Filters Manufacturer, or Equal

a. Permatron, Model MMA-2-in

B. Flat air filters shall be 2-in thick, pleated, throw-away type, and provided as an integral part of each unit. The flat air filters shall be constructed of an adhesive-coated fiber media, rated at 300 fpm face velocity; and rated at 0.04-in w.g. initial resistance and 0.50-in w.g. recommended final resistance.

1. Flat Air Filters Manufacturer, or Equal

    a. Airguard Industries
    b. Farr Co.
    c. Snyder General Corp.

C. Filter Supply

1. Furnish 3 complete spare filter changes for each flat filter in each unit.

2. Provide one new filter set in each unit at the time of turning the units over to the Owner.

3. Filters used in the units during construction are not included in the above supply, and these filters shall be provided as part of the Work.

2.15 AIR FILTER GAUGES

A. General

1. Provide air filter gauges on each make-up air handling unit and packaged heat pump.
2. The air filter gauges shall be of the inclined tube manometer type.

B. Construction

1. Provide the gauge complete with:

    a. An enameled scale with a screw-type zero adjustment
    b. A rust-resistant steel frame
    c. A 3/16-in plate glass removable cover
    d. Oil
    e. Screened inlet and outlet nozzles
    f. A level glass
    g. An oil chamber
    h. Necessary connecting piping and accessories

2. Each gauge shall be 10-in long with a total scale reading of 1.0-in water and 0.1-in scale graduations.

3. Accuracy shall be within 0.02 lineal inch at any point on the scale.

4. Gauges shall be mounted level and provided with necessary pressure sensing tubing.

5. Gauges shall not be mounted on fan housing or casings containing rotating or reciprocating machinery.

C. Air Filter Gauge Manufacturer, or Equal:

1. F.W. Dwyer Company
2. Honeywell, Inc.

2.16 WALL LOUVRES

A. General

1. Provide wall louvers where indicated.

2. Provide louvers complete with aluminum bird screen and necessary linkages for the operating section.

3. Louver sizes and capacities shall be as indicated on the Drawings.

4. Louvers shall be of the adjustable type or fixed type as indicated or required and shall be provided with a drain gutter in each blade and downspouts in jambs and mullions.

5. The louvers shall be provided with an extended sill.

B. Construction

1. Stationary blades and adjustable blades shall be contained within a single 6-in louver frame.

2. The adjustable section shall include low-leakage blade and jamb seals.

3. Louver components, including heads, jambs, sills, blades, and mullions, shall be factory-assembled by the louver manufacturer.

4. The water stop at the sill shall be factory-caulked watertight.

C. Finish

1. Provide louvers with a Kynar® 500, or equal, finish.
2. The color of the louver shall be submitted for the Engineer's approval.

D. Performance

1. Submit published louver performance data bearing the AMCA Certified Ratings Seal for Air Performance & Water Penetration, for approval prior to fabrication.

2. The performance data shall demonstrate pressure drop and water penetration equal to or less than the indicated model.

E. Fixed-type wall louvers shall be with extruded 6063T5 aluminum alloy construction as follows:

1. Frame: 0.125-in wall thickness; box-type

2. Blades: stationary section and adjustable center pivoted section; 0.125-in wall thickness; 37 ½ degree angle on approximate 4 ½-in centers

3. Operator: electric-type; furnished with louver; 120-volt maximum

F. Manufacturer, or approved equal

1. Ruskin ELF 6375DX
2. Greenheck

2.17 VIBRATION ISOLATORS

A. General

1. Provide vibration control isolation all rotating equipment except electric motors.

2. Where rotating units are part of factory-assembled package units, such as a package air handling unit, provide the isolator under the unit casing.

B. Support suspended equipment by a combination of spring and fiberglass isolation hangers, incorporating minimum 2-in thick neoprene jacketed fiberglass inserts in series with springs, encased in steel brackets.

C. Mount floor-mounted or platform-mounted built-up or package air handling units on structural steel or concrete bases with isolator springs and brackets.

D. Springs used in the vibration isolators shall have approximately 1-in of deflection under load and shall have a minimum additional travel of 50 percent between the design height and the solid height.

E. All isolation equipment shall be provided in strict compliance with the manufacturer's recommendations.

F. Pads

1. For vibration isolation between HVAC equipment and supports and where indicated, provide ¾-in thick rubber pads for full contact between equipment and support

G. The pads shall be Mason Industries, Super W Pads, or equal.

2.18 ROOF CURBS AND ROOF EQUIPMENT SUPPORTS

A. Curbs

1. Roof curbs for all roof openings for roof mounted exhaust fans and air intakes and exhausts, unless otherwise indicated, shall be of the raised cant type with a minimum 12-in height above the roof line.

2. The curbs shall be pitched at the base for roof pitches in excess of 3/8-in per foot.

3. Provide a minimum 4-in raised cant unless otherwise indicated.

4. The curbs shall be of a box design, constructed from 20-gauge galvanized steel with continuous welded seams, full mitered angle seam corners, and factory-installed wood Nailers.

5. Insulate the curbs with a minimum of 1 ½-in thick, 3 lbs. per cu.ft. density rigid board fiberglass.

6. Roof curbs shall be provided with an 18-gauge stainless steel liner set in mastic and extended the full height of curb if the duct does not extend to the top of the curb.

7. The roof curbs shall be supplied by the manufacturer of the equipment being provided.

8. Roof Curb Manufacturers, or Equal

    a. Pate Model PC-5
    b. Thy curb

B. Equipment Supports

1. Provide roof equipment supports for roof-mounted equipment.

2. Construct the supports from 180 gauge galvanized steel, with continuous welded seams, an integral base plate, a wood nailer with a 1-in overhang to accommodate insulation, and counter flashing with lag screws.

3. Provide the supports with a raised cant of not less than 4-in and a minimum of 14-in high.

4. The length and width of the units shall conform to the support requirements of the equipment being supported.

5. Roof Equipment Supports Manufacturers, or Equal

    a. Pate Model PC-5
    b. Thycurb

2.19 TEMPERATURE AND EQUIPMENT CONTROL

A. General

1. Design and provide a complete electric-electronic system of automatic temperature control as indicated.

2. The temperature control equipment and devices shall be furnished by Johnson Controls, Honeywell, or Barber Colman.

B. Wiring and Switches

1. Provide wiring incidental to the temperature control system, including electrical interlock.

2. Furnish detailed wiring diagrams along with necessary supervision.

3. Provide control wiring (line voltage or low voltage) as required to complete the temperature control system (by interconnecting starters, thermostats, PE switches, relays, and like devices) in accordance with the requirements of Section 26 00 10 – Electrical General Requirements.

4. Provide HOA switches in accordance with the requirements of Section 26 27 16 – Electrical Cabinets and Enclosures.

5. Switches shall be UL-listed and of a type to meet the current and voltage requirements of the particular application.

C. Thermostats

1. Room thermostats shall be of the digital type, provided with heating and cooling setpoints.

2. Adjustment shall be accomplished by pressing the thermostat UP or DOWN arrows.

3. Comfort Setpoints: adjustable from 66 deg F to 80 deg F

4. Setback Setpoints: adjustable from 55 deg F to 70 deg F for heating setback; adjustable from 75 deg F to 90 deg F for cooling setback

5. Automatic Setback Time Period:

   a. 7-day setback programming

   b. Up to 2 automatic setback comfort time periods per day

   c. Built-in setback override, adjustable from 10 minutes to 40 hours

   d. 7-day electric time clock

   e. Heat/cool/fan annunciators to indicate equipment operation and automatic heating/cooling changeover.

6. The thermostats shall meet the Energy Conservation Standard approval where required by the State having jurisdiction over the Project.

7. Provide an insulating back where exterior wall mounting is indicated.

8. Provide guards for room thermostats installed in areas other than administrative offices or control rooms.

D. Relays

1. Provide 2-position relays, capacity relays, sequencing relays, and other controls as necessary in order to provide a properly operating automatic control system.

2. Relays shall be UL-listed and of a type to meet the current and voltage requirements of the particular application.

E. Control Panels

1. General

   a. Control panels shall be provided with relays, control switches, transformers, pilot lights, timers, time clocks, step controllers, gages, thermostats (unless otherwise indicated), and other accessories necessary for the particular system.

b. The panels shall be of aluminum construction with a baked enamel finish and shall be provided with a hinged front door and locking handle.

c. Manual switches and direct-reading gauges shall be flush-mounted on the front face and identified by engraved and riveted Bakelite or laminated plastic nameplates with white letters on black background.

d. Manual switches shall be of heavy-duty, oil-tight construction.

2. Wiring

a. Control devices shall be prewired internally.

b. Wires leaving the panel shall be terminated at separate numbered terminal strips.

c. Provide individual connectors for every item of mechanical equipment, integral and remote pilot lights, and other devices described for each panel.

d. Power and control circuit requirements shall be as indicated on the Electrical Drawings.

e. Identify wires by color coding or numerical tags at both ends.

f. Wire each control device to the terminal strip without splices.

g. Provide integral circuit protection for panel-mounted control devices.

h. Wire each panel with a single 20-amp, 120-volt, ac feeder in accordance with the requirements of Section 26 27 16 – Electrical Cabinets and Enclosures.

3. Diagrams

a. Secure the panel electrical wiring diagrams to the inside of the panel door.

F. Sequence of Operation

2.20 PAINTING

A. Painting of the equipment and materials shall comply with the requirements of Section 09 96 00 – High-Performance Coatings.

B. Touch-Ups

1. Touch up factory-painted surfaces that are rusted or scratched.

C. Clean finishes to be touched up to bright metal, prime with a corrosion inhibitor, and finish with a coating to match the original finish.

PART 3 EXECUTION

3.1 GENERAL

A. Openings - New Construction

1. Provide necessary openings in walls, floors, and roofs for the passage of heating and ventilating equipment in the buildings.

2. Openings shall be as indicated or as required to provide passage for heating and ventilating Work.

3. Provide hanger and support inserts into masonry or structural steel as required for proper completion of the Work.

3.2 INSTALLATION OF PIPING

A. Drain Piping

1. Valve-Drain Piping

a. Provide valve-drain piping where valves are equipped with a drain connection.
b. Fabricate piping from Type L copper tube, and solder-joint drainage fittings.

2. Provide piping system and equipment drains fabricated from copper tube with solder-joint fittings, or from black steel piping with fittings as indicated.

3. Install drain piping at the low points of supply and return piping, at abrupt changes in vertical offsets in horizontal runs, and in piping at mechanical equipment including pumps.

4. Extend drain piping to the nearest drain.

B. Bypass Piping

1. Except as otherwise indicated, fabricate, and install bypass piping using the same materials and in the same plane as connected piping, but one pipe size smaller or as indicated.

2. Provide a valve in the bypass piping.

3.3 INSTALLATION OF VALVES

1. Set the valves carefully regarding their location with respect to accessibility and the equipment being controlled.

2. Consider the location of valves with respect to the proper drainage of the piping system.

3. Install valves where required for proper operation of piping and equipment, including valves in branch lines necessary to isolate sections of piping.

4. Locate valves to be accessible and such that separate support can be provided where necessary.

5. Install valves with stems pointed up, in the vertical position where possible, but in no case with stems pointed downward.

6. Where insulation is indicated, install extended-stem valves, arranged in the proper manner to receive insulation.

3.4 BALANCING TESTING

A. Balancing Subcontractor

1. After the installation Work has been completed, the Contractor shall provide the services of an independent balancing subcontractor who shall perform necessary adjustments of volume dampers, volume controllers, exhaust blowers, exhaust fans, supply blowers, supply and return registers, and heating units, chilled water, and hot water.

B. Balancing Procedures

1. Balancing and testing shall be in conformance with the requirements of Section 23 05 53 – Testing Adjusting and Balancing for HVAC.

3.5 COMMISSIONING OF HVAC

1. Commissioning of HVAC shall be in conformance with the requirements of Section 23 08 00 – Commissioning of HVAC.

3.6 VIBRATION ISOLATORS

A. Install isolation equipment in strict compliance with the manufacturer's recommendations.

3.7 TEMPERATURE AND EQUIPMENT CONTROL

A. After completion of the installation, use trained personnel to adjust thermostats, and sensors in the motors and other provided equipment, and place them in complete operating condition subject to the approval of the Engineer.

B. Instruct the operating personnel in the operation of the control system.

END OF SECTION

SECTION 23 05 29 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. The WORK included in this Section shall consist of the furnishing of all labor, and materials, for the installation of hangers and supports for the heating, ventilating, and air conditioning (HVAC) systems as indicated in the Contract Documents and herein.

B. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Reference Specifications

01 33 00	Submittal Procedures
01 33 17	Structural Design Support and Anchorage
09 96 00	High-Performance Coatings
23 31 13	Metal Ducts

B. Reference Standards

American Society of Civil Engineers (ASCE)	
ASCE/SEI 7-05	Minimum Design Loads and Associated Criteria for Buildings and Other Structures
ASCE 7-10	Minimum Design Loads for Buildings and Other Structures
American Society of Mechanical Engineers (ASME)	
ASME BPVC	Boiler and Pressure Vessel Code
ASME B31.9	Building Services Piping
American Welding Society (AWS)	
AWS D1.1/D1.1M	Structural Welding Code—Steel
ASTM International (ASTM)	
ASTM C552	Standard Specification for Cellular Glass Thermal Insulation
ASTM C591	Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C533	Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
ASTM A36/A36M	Standard Specification for Carbon Structural Steel
ASTM C1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)	
MSS SP-58	Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-69	Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)
MSS SP-89	Pipe Hangers and Supports - Fabrication and Installation Practices
Society of Protective Coatings (SSPC)	
SSPC-PA 1	Shop, Field, and Maintenance Coating of Metals

C. Reference Standards

1. Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

2. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

3. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

4. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

5. Design trapeze pipe hangers and equipment supports, including comprehensive engineering Analysis by a qualified professional engineer, using performance requirements and design criteria as indicated.

6. Comply with spec section 01 33 17 – Structural Design Support and Anchorage

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures

B. Product Data: For each type of product indicated.

C. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

D. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

3. Welding Certificates

1.4 QUALITY ASSURANCE

A. Comply with Special Inspection Requirements of IBC 2009.

B. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Pipe Welding Qualifications: Qualify procedures and operators according to ASME boiler and Pressure Vessel Code.

PART 2 PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon Steel Pipe Hangers and Supports

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.

3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.

2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.
c. Flex-Strut Inc.

d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut Corporation; Tyco International, Ltd.
g. Wesanco, Inc.

2. Description: Shop or field-fabricated pipe-support assembly for supporting multiple parallel pipes.

3. Standard: MFMA-4.

4. Channels: Continuous slotted steel channel with in-turned lips.

5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

7. Metallic Coating: Hot-dipped galvanized.

8. Paint Coating: Vinyl or Acrylic.

9. Plastic Coating: PVC.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100 psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125 psi minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C533, Type I calcium silicate with 100 psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125 psi minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2-in beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

2. Base: Plastic.

3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous thread rods.

4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

2. Bases: One or more; plastic.

3. Vertical Members: Two or more protective-coated-steel channels.

4. Horizontal Member: Protective-coated-steel channel.

5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000 psi, 28-day compressive strength.

PART 3 EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Anchorage and bracing for all suspended ductwork and other distribution systems needs to be provided per 2016 CBC Section 1613/ASCE 7-10 Chapter 13

B. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support- piping from the building structure.

C. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

F. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4-in thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, DN 65 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

O. Comply with spec section 01 33 17 – Structural Design Support and Anchorage

P. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight distribution plate for pipe DN 100 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight distribution plate for pipe DN 100 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. DN 8 to DN 90: 12-in long and 0.05-in thick.
    b. DN 100: 12-in long and 0.06-in thick.
    c. DN 125 and DN 150: 18-in long and 0.06-in thick.
    d. DN 200 to DN 350: 24-in long and 0.075-in thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1.5-in.

3.5 PAINTING

A. Touchup: 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.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 0.002-in.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 09 96 00 – High-Performance Coatings and Section 09 96 00 – High-Performance Coatings.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes DN 15 to DN 750.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes DN 100 to DN 600, requiring up to 4-in of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes DN 20 to DN 900, requiring clamp flexibility and up to 4-in of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes DN 15 to DN 600 if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes DN 15 to DN 100, to allow off center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes DN 20 to DN 200.

7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes DN 15 to DN 200.

8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes DN 15 to DN 200.

9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes DN 15 to DN 200.

10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes DN 10 to DN 200.

11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes DN 10 to DN 80.

12. U-Bolts (MSS Type 24): For support of heavy pipes DN 15 to DN 750.

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14. Pipe Saddle Supports (MSS Type 36): For support of pipes DN 100 to DN 900, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes DN 100 to DN 900, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes DN 65 to DN 900 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes DN 25 to DN 750, from two rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes DN 65 to DN 600, from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes DN 50 to DN 1050 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes DN 50 to DN 600 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes DN 50 to DN 750 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers DN 24 to DN 600.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers DN 20 to DN 600 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6-in for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 deg F to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120 deg F to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb
    b. Medium (MSS Type 32): 1500 lb
    c. Heavy (MSS Type 33): 3000 lb

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1 ¼-in

3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.

6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.

8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

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SECTION 23 05 48 – VIBRATION AND SEISMIC CONTROLS FOR HVAC

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, and Section 01 33 17 – Structural Design Support and Anchorage, apply to this Section.

1.2 THE SUMMARY

A. Section Includes:

1. Isolation pads
2. Isolation mounts
3. Restrained elastomeric isolation mounts
4. Freestanding and restrained spring isolators
5. Housed spring mounts
6. Elastomeric hangers
7. Spring hangers
8. Spring hangers with vertical-limit stops
9. Pipe riser resilient supports
10. Resilient pipe guides
11. Seismic snubbers per Section 01 33 17 – Structural Design Support and Anchorage
12. Restraining braces and cables
13. Steel and inertia, vibration isolation equipment bases.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Definitions

1. IBC: International Building Code
2. ICC-ES: ICC-Evaluation Service
3. OSHPD: Office of Statewide Health Planning and Development for the State of California

B. Reference Specifications

01 33 17	Structural Design Support and Anchorage
01 79 00	Owner Staff Training
23 21 00	Hydronic Piping and Pumps

C. Reference Standards

American Association of State Highway and Transportation Officials (AASHTO)	
American Society of Civil Engineers (ASCE)	
ASCE/SEI 7-05	Minimum Design Loads for Buildings and Other Structures
ASCE 7-05	Wind Loads: Guide to the Wind Loads Provisions of ASCE 7-05
American Welding Society, Inc. (AWS)	
AWS D1.1/D1.1M	Structural Welding Code

ASTM International (ASTM)	
ASTM A36/A36M	Standard Specification for Carbon Structural Steel
ASTM A603	Standard Specification for Zinc-Coated Steel Structural Wire Rope
ASTM A492	Standard Specification for Stainless Steel Rope Wire
ASTM E488	Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)	
MSS SP-127	Bracing for Piping Systems: Seismic – Wind – Dynamic Design, Selection and Application

1.4 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Comply with ASCE/SEI 7-05 and 2022 OSSC
2. Comply with Section 01 33 17 – Structural Design Support and Anchorage
3. Basic Wind Speed (3-second gust): 105 MPH
4. Assigned Occupancy Category as Defined in the 2022 OSSC: III
5. Wind restraint forces for HVAC equipment and supports shall be determined in accordance with the adopted Oregon Structural Specialty Code and the general notes and design criteria in the Structural drawings.
6. Refer to Structural Drawing GS-1 – General Notes and Design Criteria and the associated specifications for detailed information regarding wind load requirements.

B. Seismic-Restraint Loading:

1. Comply with ASCE/SEI 7-05 and 2022 OSSC
2. Comply with Section 01 33 17 – Structural Design Support and Anchorage
3. Site Class as Defined in the 2022 OSSC
4. Assigned Occupancy Category as Defined in the 2022 OSSC: III
    a. Component Importance Factor, Ip: 1.25
    b. Component Response Modification Factor, Rp: varies, refer to ASCE 7-05 Table 13.6-1
    c. Component Amplification Factor, ap: varies, refer to ASCE 7-05 Table 13.6-1
5. Design Spectral Response Acceleration at Short Periods (0.2 Second), Ss: 0.647
6. Design Spectral Response Acceleration at 1-Second Period, S1: 0.478
7. Refer to Structural Drawing GS-1 – General Notes and Design Criteria and the associated specifications for detailed information regarding seismic requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.

b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic and wind forces required to select vibration isolators, seismic and wind restraints, and for designing vibration isolation bases.

a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.

3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

4. Comply with Section 01 33 17 – Structural Design Support and Anchorage

5. Seismic- and Wind-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.

b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

e. Comply with Section 01 33 17 – Structural Design Support and Anchorage

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer
B. Welding certificates
C. Field quality-control test reports

1.7 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Comply with Section 01 33 17 – Structural Design Support and Anchorage.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATORS

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

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation
4. Isolation Technology, Inc.
5. Kinetics Noise Control
6. Mason Industries
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation
9. Vibration Mountings & Controls, Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant rubber or hermetically sealed compressed fiberglass.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge bearing neoprene as defined by AASHTO.

E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

2. Minimum Additional Travel: 50 percent of the required deflection at rated load.

3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Baseplates: Factory drilled for bolting to structure and bonded to 0.24 in thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psi.

6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 0.24 in thick, neoprene or rubber

isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4. Minimum Additional Travel: 50 percent of the required deflection at rated load.

5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

G. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.

2. Base: Factory drilled for bolting to structure.

3. Snubbers: Vertically adjustable to allow a maximum of 0.24 in travel up or down before contacting a resilient collar.

H. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

I. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

J. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

K. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 0.5 in thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 3.45 MPa and for equal resistance in all directions.

L. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 0.5 in thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements

2.2 VIBRATION ISOLATION EQUIPMENT BASES

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

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation
3. Isolation Technology, Inc.
4. Kinetics Noise Control
5. Mason Industries
6. Vibration Eliminator Co., Inc.
7. Vibration Isolation
8. Vibration Mountings & Controls, Inc.

B. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1 in clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

    a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Bases shall have shape to accommodate supported equipment.

3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

C. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1 in clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

    a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.

3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

D. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.3 SEISMIC-RESTRAINT DEVICES

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

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation
3. Cooper B-Line, Inc.; a division of Cooper Industries
4. Hilti, Inc.
5. Kinetics Noise Control
6. Loos & Co.; Cableware Division
7. Mason Industries
8. TOLCO Incorporated; a brand of NIBCO INC.
9. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A603 galvanized or ASTM A492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

F. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488. Minimum length of eight times diameter.

J. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488.

2.4 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.

2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.

3. Baked enamel or powder coat for metal components on isolators for interior use.

4. Color-code or otherwise mark vibration isolation and seismic- and wind-control devices to indicate capacity range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

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

D. Comply with Section 01 33 17 – Structural Design Support and Anchorage.

3.2 APPLICATION

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Refer to drawings for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.13 in.

3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Piping Restraints:

1. Comply with requirements in MSS SP-127.

2. Space lateral supports a maximum of 39.4 ft o.c.., and longitudinal supports a maximum of 78.7 ft o.c.

3. Brace a change of direction longer than 12.1 ft

D. Install cables so they do not bend across edges of adjacent equipment or building structure.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

I. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.

5. Set anchors to manufacturer's recommended torque, using a torque wrench.

6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 23 21 00 - Hydronic Piping and Pumps for piping flexible connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Comply with Section 01 33 17 – Structural Design Support and Anchorage.

C. Perform tests and inspections.

D. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.

3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.

5. Test to 90 percent of rated proof load of device.

6. Measure isolator restraint clearance.

7. Measure isolator deflection.

8. Verify snubber minimum clearances.

9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

E. Remove and replace malfunctioning units and retest as specified above.

F. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.7 DEMONSTRATIONS

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Section 01 79 00 – Owner Staff Training

END OF SECTION

SECTION 23 05 53 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall provide HVAC Piping and Equipment, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Reference Specifications

23 05 23	General Duty Valves for HVAC Piping

B. Reference Standards

ASME International (ASME)	
ASME A13.1	Scheme for the Identification of Piping Systems

1.3 CONTRACTOR SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.031-in. minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2.5-in. by 0.75-in.

3. Minimum Letter Size: 0.25-in for name of units if viewing distance is less than 24-in, 0.5-in. for viewing distances up to 72-in, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel rivets or self-tapping screws.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 0.125-in thick, and having predrilled holes for attachment hardware.

2. Letter Color: Black.

3. Background Color: White.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2.5-in by 0.75-in.

6. Minimum Letter Size: 0.25-in for name of units if viewing distance is less than 24-in, 0.5-in for viewing distances up to 72-in, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on A4 bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 0.125-in thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2.5-in by 0.75-in.

F. Minimum Letter Size: 0.25-in for name of units if viewing distance is less than 24-in, 0.5-in for viewing distances up to 72-in, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1.5-in high.

2.4 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 0.125-in thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2.5-in by 0.75-in.

F. Minimum Letter Size: 0.25-in for name of units if viewing distance is less than 24-in, 0.5-in for viewing distances up to 72-in, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.

2. Lettering Size: At least 1.5-in high.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 0.25-in letters for piping system abbreviation and 0.5-in numbers.

1. Tag Material: Brass, 0.032-in minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on A4 bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4-in by 7-in.

2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

4. Color: Yellow background with black lettering.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 ft along each run. Reduce intervals to 25 ft in areas of congested piping and equipment.

B. Pipe Label Color Schedule:

1. Heating Water Piping:

   a. Background Color: Black.
   b. Letter Color: White.

2. Refrigerant Piping:

   a. Background Color: Black.
   b. Letter Color: White

3.4 DUCT LABEL INSTALLATION

A. Install plastic-laminated, self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 ft in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Refrigerant: 2-in, round
   b. Hot Water: 2-in, round.

2. Valve-Tag Color:

   a. Refrigerant: Natural.
   b. Hot Water: Natural.

3. Letter Color:

   a. Refrigerant: Black.
   b. Hot Water: Black

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 23 05 93 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

A. The Work included in this Section shall consist of the furnishing of all labor, instruments, tools, and services as required for the total system balancing of the heating, ventilating, and air conditioning (HVAC) systems as indicated in the Contract Documents.

B. The Work under this Section shall include the following items:

1. Preparation for balancing of air systems
2. Preparation for balancing of hydronic and steam systems
3. Preparation of control systems
4. Notification requirements by the General Contractor of systems readiness

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Reference Standards

Associated Air Balance Council (AABC)	
American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)	
ASTM International (ASTM)	
American National Standards Institute (ANSI)	
ANSI S1.13	(2020) American National Standard Measurement of Sound Pressure Levels in Air

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 GENERAL

A. Testing, adjusting, and balancing (TAB) of the air conditioning systems and related ancillary equipment shall be performed by a certified, independent third-party, AABC Agency, selected and employed by the Contractor and approved by the Owner.

B. The preparation for and corrections necessary for the testing, adjusting, and balancing of these systems, as described herein, are the responsibility of the Contractor.

C. Make changes or replacements to fan sheaves and belts, dampers, valves, and the like, as may be required for correct balance as advised by the TAB firm, as part of the Work.

D. Provide and coordinate the services of qualified, responsible subcontractors, suppliers, and personnel, as required to correct, repair, or replace deficient items or conditions found during the course of the Project, including the testing, adjusting, and balancing period.

E. Operate the systems for the length of time necessary to properly verify their completion and readiness for TAB.

F. Scheduling

1. Project completion schedules shall allow for sufficient time to permit the completion of TAB services prior to Owner occupancy.

2. Allow adequate time for coordinating Owner-required services associated with the testing and balancing activities during the construction period and prior to Substantial Completion.

G. Accessibility

1. Install valves, dampers, and miscellaneous adjustment devices in a manner that will leave them accessible and readily adjustable.

2. Should any such device not be readily accessible, provide access as requested by the TAB firm.

3. Malfunctions encountered by TAB personnel and reported to the Contractor shall be corrected by the Contractor immediately such that the balancing work can proceed with minimal delays.

H. The TAB firm shall check, adjust, and balance the components of the HVAC system in order to obtain the optimal performance of the equipment.

I. The Work is intended to be accomplished after the system components are installed and operating as indicated and required.

J. It shall be the responsibility of the Contractor to place the equipment into service.

K. The following components of the HVAC systems shall be tested, adjusted, and balanced:

1. Air moving equipment
2. Air distribution systems
3. Heating and cooling systems
4. Control systems (testing and verification)

3.2 FIELD TESTING

A. During the progress of the work, tests shall be performed as indicated and as required by authorities having jurisdiction, including the local building department, the Owner, the Owner's insuring agency, and the Engineer.

B. Perform such tests as part of the Work, including qualified personnel, equipment apparatus, additional thermometer wells, gauge connections, instrument connections, and services as required to perform the tests.

C. Submit 6 copies of each complete test report to the Engineer for review and send 2 copies of the accepted report to the Owner.

3.3 DEFECTIVE WORK

A. Leaks, damage, and defects discovered or resulting from tests shall be repaired or replaced to a like-new condition.

B. Leaky pipe joints, ductwork, and the like, shall be removed and replaced with acceptable materials.

C. Reporting

1. During the balancing process, as abnormalities and malfunctions of equipment or components are discovered by the TAB personnel, the TAB firm shall advise the Engineer and Owner in writing such that the conditions may be corrected by the Contractor.

2. The written document need not be formal but must be understandable and legible.

3. The TAB firm shall not instructor direct subcontractors in any of the Work.

3.4 CONTRACTOR'S RESPONSIBILITIES

A. Have the building and air conditioning systems in complete operational readiness for the TAB Work to begin.

B. Allow sufficient time for the TAB firm to perform their Work within the construction schedule.

C. Complete the Work by systems or floors, whichever is the more efficient method for testing systems.

D. Scheduling

1. Within 2 weeks after the construction schedule has been developed, schedule a TAB coordination meeting to include the TAB firm, the Contractor and primary subcontractors, the Engineer, and the Owner, for the purpose of developing a testing schedule for the Project.

2. Submit copies of the proposed schedule to the TAB firm at least two week prior to the coordination meeting.

E. Promptly correct deficiencies of materials and workmanship identified as delaying completion of the TAB firm's Work.

F. Assume responsibility for added costs to the Owner resulting from failure to have the building and air conditioning systems ready for TAB when scheduled, and from failure to correct deficiencies promptly.

G. Coordinate with the TAB firm to compile and submit:

1. one set of HVAC specifications
2. one copy of relevant revisions, clarifications, and modifications
3. one complete set of Drawings, less the Civil and Structural sheets
4. one set of the HVAC floor plans of the conditioned spaces
5. one copy of approved submittal data for installed equipment

6. one copy of related changes as required to accomplish the indicated test procedures

3.5 TAB FIRM RESPONSIBILITIES

A. The following observations and tests shall be performed by the TAB firm:

1. During the construction submittal stage and before the submittal documents are finalized, review the mechanical and HVAC submittals, drawings and specifications for balance-ability and furnish commentary.

2. During construction, review approved HVAC submittals such as control diagrams, air handling devices, and the like, that pertain to TAB work and balancing.

3. Perform construction observations and submit a written report including the following topics.

a. The ductwork prior to insulation and ceiling cover-up
b. The piping prior to insulation and ceiling cover-up

4. Perform a pre-balance site review and submit a written report.

3.6 OPERATIONAL READINESS

A. "Operational readiness," as referred to in this Section, shall be defined as the time when the construction status of the building permits the closing of doors, windows, ceilings, and the like, to obtain simulated or projected operating conditions.

B. Operational readiness of the HVAC system shall require that the following items have been accomplished:

1. Air Distribution Systems

a. The installation conforms to the indicated design requirements.

b. Volume, smoke, and smoke/fire dampers have been properly located and are functional.

c. Dampers have tight closure and open fully with smooth and free operation.

d. Supply, return, exhaust, and transfer grilles, registers, diffusers, and terminal devices have been installed and secured in a fully open position.

e. Air handling systems, units, and associated apparatus, such as heating and cooling coils, filter sections, access doors, and the like, have been sealed to eliminate uncontrolled bypass or leakage of air.

f. Final clean filters are in place, coils are clean with fins straightened, bearings are properly greased, belts are aligned and tightened, and the system is completely operational.

g. It has been verified that all systems are operating within the design pressure limits of the piping and ductwork.

h. Fans (supply, return, and exhaust) are operating and verified for freedom from vibration, proper fan rotation and belt tension.

i. Heater elements in motor starters are of proper size and rating, in accordance with the starter manufacturer's requirements.

j. Motor amperage and voltage have been recorded on each phase at start-up and verified that they do not exceed nameplate ratings.

k. Terminal units (mixing boxes and fan powered boxes) have been installed and controls are functional.

2. Automatic Controls

a. A meeting has been held with the Engineer, the TAB firm, and the Owner, for a pre-submittal review of the proposed controls strategy.

b. Control components have been installed in accordance with project requirements and are functional, including electrical interlocks, damper sequences, air and water resets, fire and freeze stats, high- and low-temperature thermostats, safeties, and the like.

c. Controlling instruments have been calibrated and set for design operating conditions, with the exception of components that require input from the TAB firm, but a default has been set.

1) Cooperate with the TAB firm and provide all software and interfaces to communicate with the system.

d. Controls, sensors, operators, sequences, and the like, have been checked before notifying the TAB firm that the Energy Management System is operational.

1) Furnish technical support (technicians and necessary computers) for a complete check of these systems.

e. Fire alarm detection devices, sequences, inter-locks, and the like, have been checked before notifying the TAB firm that the system is operational.

1) Checked devices shall include the Fireman's Override Panel.

2) Provide all detection devices (fire and smoke), complete with all smoke zones identified along with all alarm and event chart devices identified.

3) Certify that the systems are totally operational prior to the TAB beginning.

f. A start-up report has been submitted.

1) The start-up report shall include the submitted and actual RPM, and the actual and nameplate voltage and amperage of all motors.

2) This requirement applies to each piece of electrically driven air conditioning equipment in the system, including supply and exhaust fans, other fans of fractional horsepower, pumps, and the like.

3) Furnish the addresses and initial set points of all controlled devices.

3.7 NOTIFICATION OF SYSTEM READINESS

A. After the above operational readiness items have been accomplished, notify the Engineer in writing, certifying that the Work has been accomplished and that the building and the air conditioning systems are in operational readiness for testing, adjusting, and balancing.

B. With the notification, include a copy of tabulated data as required.

C. The Engineer will notify the TAB firm of the readiness for balancing, and forward copies of the Contractor's certification and tabulated motor voltages, currents, and RPM.

D. If the TAB firm has been notified as described above and the inspection reveals that the TAB services notification is premature, costs of the inspection and wasted work accomplished by the TAB firm shall be reimbursed to the appropriate parties by the Contractor.

3.8 TESTING AND BALANCING

A. In coordination with the TAB firm, submit an overview of system TAB procedures including:

1. An agenda

2. Field observation reports

3. System testing, including:

a. Traverses to be made
b. Instrumentation to be used
c. How correction factors for grilles and diffusers will be obtained
d. How measurements will be verified at maximum and minimum
e. How control components will be verified

4. Report forms with each systems components identified and numbered.

3.9 INSTRUMENTATION

A. Ensure that instruments being used are currently calibrated and listed in the TAB report, showing instrument description, serial number, and date of calibration.

B. The accuracy of instruments used shall be as indicated in the current AABC National Standards.

3.10 FINAL AIR BALANCE

A. When systems are complete and ready for operation, the TAB firm shall perform a final air balance for all air systems and record the results.

B. The volume of air for the supply, return, exhaust, and outside air equipment and terminals shall be tested and balanced within the tolerances of the AABC Standard.

C. Air handling unit and fan volumes shall be adjusted by changing fan speed.

D. Air distribution device volume shall be adjusted using the spin-in damper for flexible duct-connected devices, and the damper for duct-connected devices.

E. Air distribution devices shall be balanced with air patterns as indicated.

F. Duct volume dampers shall be adjusted to provide air volume to branch ducts where such dampers are indicated.

G. The general scope of balancing by the TAB firm shall include the following items:

1. Filters: Check air filters and filter media and balance only systems with essentially clean filters and filter media.

2. Fan Speed: Measure and record RPM at each fan speed.

3. Voltage and Amperage Readings: Measure and record the final operating amperages and voltage for each motor.

4. Static Pressure Profile

    a. Static pressure profiles shall be measured and recorded across each supply fan, cooling coil, heating coil, return air fan, air handling unit filter, and exhaust fan, and at the furthest air device or terminal unit from the air handler supplying that device.

    b. Furnish static pressure profiles for systems which do not perform as designed.

5. Equipment Air Flow: Adjust and record exhaust, return, outside, and supply air CFM and temperatures, as applicable, at each fan and coil.

6. Coil Temperatures

    a. Set controls for full cooling and for full heating loads.

    b. Read and record entering and leaving dry bulb and wet bulb temperatures (cooling only) at each cooling coil, heating coil, and HVAC terminal unit.

    c. At the time of reading, record water flow and entering and leaving water temperatures.

    d. In variable flow systems, adjust the air and water flow to design for all the above readings.

7. Zone Air Flow: Adjust each zone of multizone units, each HVAC terminal unit, and air handling unit for design CFM.

8. Outlet Air Flow

    a. Adjust each exhaust inlet and supply diffuser, register and grille to within the tolerances shown in the AABC Standard.

    b. Include all terminal points of air supply and all points of exhaust.

9. Pitot Tube Traverses

    a. For use in future troubleshooting by maintenance personnel, measure air velocity in all exhaust ducts, main supply ducts, outside air, and return ducts, and record by the Pitot tube traverse method shown in the AABC Standard.

    b. Locations of these traverse test stations shall be described both verbally and by graphic representation on the sheet containing the data.

10. Maximum and minimum airflow on terminal boxes shall be adjusted, measured, and recorded.

3.11 SOUND

A. Read and record sound levels at up to 15 locations in the building designated by the Engineer, and show that all areas are within acceptable sound levels in accordance with ASTM and ASHRAE Standard Test method for measurement of sound in commercial Spaces, or the American National Standard Institute's Methods for the Measurement of Sound Pressure Levels, ANSI S1.13.

B. Perform measurements using an octave band analyzer.

C. Conduct the tests when the building is quiet and in the presence of the Engineer.

3.12 TESTING OF TEMPERATURE CONTROL SYSTEMS

A. Coordinate with the Contractor in order to ensure that the most effective total system operation is within the design limitations, and to obtain a mutual understanding of the intended control performance.

B. Verify that all control devices are properly connected and operated by the intended controller.

C. Observe that all valves are properly installed in the piping system in relation to direction of flow and location.

D. Observe the calibration of all controllers.

E. Verify the proper application of all normally opened and normally closed valves.

F. Sensors

1. Observe the locations of all sensors in order to verify whether their position will allow them to sense the intended temperatures and pressures of the media accurately.

2. The Contractor shall relocate the sensors as deemed necessary by the TAB firm.

    a. Verify that the sequence of operation for control modes is in accordance with approved Shop Drawings and as indicated.

    b. Verify the proper operation of all interlock systems.

    c. Perform variable volume system verification in order to assure the system and its components track, with changes from full flow to minimum flow.

3.13 TAB FINAL ACCEPTANCE AND BALANCING

A. At the time of TAB final acceptance inspection, the TAB firm shall recheck, in the presence of the Engineer, specific and random selections of data that were recorded in the certified test and balance report.

B. Points and areas for recheck shall be selected by the Engineer.

C. Measurements and test procedures shall be the same as the submitted and approved test and balance agenda.

D. Selections for verification, specific plus random, shall not exceed 10 percent of the total number tabulated in the report, except where special air systems require a complete recheck for safety reasons.

E. If 10 percent of the random verification tests demonstrate a measured flow deviation of 10 percent or more from that recorded in the certified test and balance report, the report shall be automatically rejected.

F. In the event the report is rejected, all systems shall be readjusted and tested, new data recorded, a new certified test and balance report submitted, and a new inspection test made, as part of the Work.

G. Final Acceptance will not occur until after the successful completion of the TAB verification process.

END OF SECTION

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SECTION 23 07 00 – HVAC INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall provide pipe and equipment insulation, complete and in place, as indicated in accordance with the Contract Documents.

B. In addition to the insulation indicated, the Contractor shall insulate cold or hot piping and exhausts that could be hazardous to personnel upon contact.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Reference Specifications

01 33 00	Submittal Procedures

B. Federal Specifications

HH-1-558B	Insulation Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type)

C. Commercial Standards

ASTM International (ASTM)	
ASTM C547	Mineral Fiber Pipe Insulation
ASTM E84	Test Method for Surface Burning Characteristics of Building Materials
ASTM C1136	Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C1290	Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
National Fire Protection Association (NFPA)	
NFPA 90A	Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	Standard for the Installation of Warm Air Heating and Air Conditioning Systems

1.3 CONTRACTOR SUBMITTALS

A. Submit complete Shop Drawings of thermal insulation, with manufacturer's data on materials, covering, jackets, and finish, in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. Furnish the following certifications:

1. Certification from the heating system manufacturer that the insulation has been installed in accordance with the manufacturer's recommendations.

2. Certification from the acoustic insulation/duct lining manufacturer that the lining has the indicated sound absorption coefficients.

PART 2 PRODUCTS

2.1 GENERAL

A. Components of the insulation, including covering, mastics, and adhesives, shall have a flame-spread rating of not greater than 25 and a smoke development rating of not greater than 50.

B. Ratings shall be as established by tests in accordance with ASTM E84, and the above federal and commercial specification standards.

C. Insulation shall be applied in strict accordance with the manufacturer's instructions.

2.2 BASIC MATERIALS

A. Unless otherwise indicated, the insulation thickness shall be as follows:

Pipe		**Minimum Thickness of Insulation (inches)**
Hot and cold potable water	6-in and smaller	1
	8-in and larger	1 ½
Low-pressure steam (50 psig and less)	4-in and smaller	1
	5-in and larger	1 ½
High-pressure steam (51 psig and greater)	all sizes	3
Condensate, boiler blowdown, and boiler feed	8-in and smaller	1 ½
	10-in and larger	2
Compressed air piping and liquid refrigerant piping exposed to the weather	all sizes	2
Equipment and Tanks	Minimum Thickness of Insulation inches	
Boilers, heaters, and manufactured equipment	as recommended by manufacturer	

2.3 PIPING INSULATION

A. Except as indicated otherwise, piping shall be insulated with heavy density, unfaced, fiberglass pipe insulation.

B. Pipe insulation shall have an average density of 4 pounds per cubic foot or greater, and its conductivity (k) shall not exceed 0.23 BTU-inch per (hour) (sq ft) (deg F) at a mean temperature of 75 deg F.

C. Supporting Hangers

1. For 3-in piping and larger, the insulation shall be protected at supporting hangers by the suitable hollow steel protection saddles, filled with loose glass fiber insulation as indicated.

2. For piping smaller than 3-in, place 1/16-in thick sheet metal shims between the insulation and the supporting hanger; the shim shall be at least 6-in long.

3. The insulation shall be oversized for installation over electric heating cable.

4. The insulation shall have a factory-applied white fire-retardant vapor-barrier jacket of kraft paper and aluminum foil laminated together and reinforced with fiberglass yarn.

5. Fittings and valves shall be covered with the same material as the pipe, cut in segments to fit snugly without open spaces, held in place with copper wire or cement, and then covered with the same jacketing material as the pipe.

6. Insulated fittings adjacent to vapor-barrier insulation shall be sealed with an acceptable vapor-barrier cement before installation of the finish jacket.

7. The pipe insulation and vapor-barrier shall be continuous through hangers and supports.

8. Where insulation is indicated for the top-half segment of pipe, insulation at support locations shall be of the same density.

9. The bottom-half insulation segments provided between the pipe and the insulation protection shields shall have a density of not less than 6 lb/cu ft.

D. Jacketing

1. A final covering of the insulation for piping shall be of 0.030-in thick PVC or equivalent strength smooth aluminum, preformed jacketing with a factory-attached moisture barrier.

2. Valves, flanges, fittings, and ends of insulation shall be covered with a pre-molded, precision-formed, high-low temperature PVC fitting cover or end cap, or equivalent preformed unit to match the piping insulation jacket.

3. The pre-molded covers shall be sized to receive the same thickness of insulation as used on the adjacent piping, and shall be sized to cover and protect the insulated fitting.

4. Joints shall be sealed with silicone mastic or solvent welding to provide a continuous air- and weather-tight joint.

5. Strapping shall be ½-in wide, Type 3003 aluminum or stainless steel.

6. Pre-molded fittings shall be Zeston 2000 PVC, or equal.

E. Standard Temperature Insulation

1. Standard temperature insulation shall be used for process, cold and hot water, steam, and condensate piping and equipment with surface temperatures up to 850 deg F.

2. Pipe insulation and jacketing shall be applied to piping where indicated, including associated fittings, flanges, and valves.

3. Pipe insulation shall consist of a molded-type pipe covering, constructed of fibrous glass with a minimum k-factor of 0.23 at 75 deg F mean temperature.

F. High Temperature Insulation

1. High temperature insulation shall be employed for engine exhaust pipes, flues, and similar pipes and equipment with surface temperatures up to 1200 deg F.

2. High temperature insulation shall consist of 4-in thick calcium silicate or similar pre-molded blocks, constructed in 2 layers of 2-in thickness each with staggered joints, and applied over a ¾-in high metal rib lath.

3. The inner layer shall be suitable for 1200 deg F, and the outer layer for 1000 deg F.

4. Bends, voids, joints, fittings, and other parts of the piping system shall be filled with insulating cement.

5. Aluminum lagging with preformed aluminum fittings shall be banded to the insulation in a similar fashion as required for standard insulation.

6. Allowance shall be made for thermal expansion.

G. Manufacturers, or Equal

1. Armstrong Contracting and Supply Corp.
2. Certain-Teed Corporation
3. Johns Manville
4. Owens-Corning
5. P.P.G. Industries, Inc.

2.4 SOURCE QUALITY CONTROL

A. Provide acoustical-thermal insulation on blower inlet, discharge and blowoff piping, including fittings, flanges, valves, couplings, meters, silencers, and appurtenances.

B. Acoustical Insulation

1. Acoustical insulation shall consist of ½-in thick fiberglass laminated to a lead barrier having a density of 16 ounces per square foot.

2. The fiberglass/lead barrier shall have a temperature rating to 350 deg F and shall be **Hushcloth** as manufactured by **American Acoustical Products**, **Alpha Associates, Inc.**, or equal.

3. The acoustical insulation shall overlap at least 2 in in both the transverse and longitudinal directions and shall be installed to avoid sagging or gapping.

C. Scrim

1. The acoustical insulation shall be held in place by the use of scrim fabric at least 6-in wide.

2. Provide at least 2 wraps of scrim per length of acoustical insulation.

3. The scrim shall be 5 x 5-thread-count fiberglass mesh, with a thread thickness of 0.03-in and weighing 5.8 ounces per square yard.

4. Scrim shall be Alpha Associates Luben 8405, or equal.

D. Thermal Insulation

1. The acoustical insulation shall be covered by a fiberglass thermal insulation and fiberglass lagging fabric.

2. The thermal insulation shall have an average density of 4 pounds per cubic foot or greater, and its conductivity (k) shall not exceed 0.23 BTU-inch per (hour) (sq ft) (deg F) at a mean temperature of 75 deg F.

3. The thermal insulation shall be as manufactured by **Manville, Owens-Corning**, or equal.

E. Lagging Fabric

1. The final covering shall be a 100 percent fiberglass lagging fabric, with a thickness of 0.034-in and weighing 19 ounces per sq yd.

2. The lagging fabric shall be Alpha Associates (Style 2025), J.P. Stevens Co., or equal.

F. Compression Couplings and Expansion Joints

1. Compression couplings and expansion joints on piping shall be covered as indicated, using rigid insulation block.

2. The insulation block shall be composed of hydrous calcium silicate, and segmented to wrap around the piping.

G. Manufacturers, or Equal

1. Manville, Thermo 12
2. Owens-Corning, Kaylo 10

H. Valves and flanges shall be covered in a similar manner to the adjacent piping.

2.5 ANTI-CONDENSATION PIPING INSULATION

A. In general, piping 5-in and larger in diameter for raw water, settled water, filtered water, service water, water tanks, and as indicated, shall be insulated.

B. The insulation shall be a flexible closed-cell elastomeric thermal insulation, black in color and provided with a smooth skin on one side to form the outer exposed insulation surface.

C. The insulation shall be supplied in sheets and rolls, as follows:

Thickness	1/8-in to 2-in
Thermal conductivity	0.27 BTU-inch per (hour) (sq ft) (deg F) at a mean temperature of 75 deg F
Water vapor permeability	0.10 perm-in
Water absorption	6 percent maximum
Upper use limit	180 deg F
Lower use limit	-40 deg F
Flame-spread rating	25 or less
Smoke-developed rating (thickness to ¾-in)	50 or less
Smoke-developed rating (thickness 1-in or greater)	100 or less

D. Manufacturer, or Equal

1. Armstrong, AP Armaflex Sheet and Roll

2.6 DUCTWORK INSULATION

A. Supply ductwork and outside air ductwork shall be insulated as indicated under this Section.

B. Insulation shall be provided for air duct systems operating at internal air temperatures up to 250 deg F.

C. The finished duct system shall meet the requirements of NFPA 90A and 90B.

D. Duct wrap insulation shall meet the requirements of ASTM C1290, Type III, to a maximum service temperature of 250 deg F.

E. Facing material shall meet the requirements of ASTM C1136, Type II, when surface burning characteristics are determined in accordance with ASTM E84 with the foil surface of the material exposed to the flame.

F. Density and Thickness

1. Density: 1.5 lbs per cu ft

2. Thickness: 1 ½-in or 2 in, as indicated

G. The duct wrap insulation shall consist of a blanket of glass fibers factory-laminated to a reinforced foil/ kraft (FRK) vapor retarder facing, with a 2-in wide (minimum) stapling and taping flange on one edge.

H. The duct wrap insulation shall provide installed R-values as indicated in the following table:

Density, lbs/cu ft	Nominal Thickness, Inches	R-value1,2, (hour) (sq ft) (deg F) per BTU
1.50	1 ½	6.0
1.50	2	8.0

[1] at 75 deg F mean temperature
[2] assumes 25 percent compression of insulation

I. Exposed Ductwork

1. Ductwork with exterior insulation which is exposed to the weather shall be protected with an aluminum-magnesium alloy jacket having a minimum thickness of 0.016-in.

2. The jacketing shall include built-in isolation felt.

3. The jacket shall be lapped at least 3-in at joints, and secured with stainless steel bands on 6-in centers.

J. Duct Lining

1. The fiberglass ductwork lining shall be 1-in thick, and shall have a density 1 ½-lbs/cu ft.

2. The liner shall have a flame spread rating of 25 or less, a smoke development rating of 50 or less, an average thermal conductivity not to exceed 0.23 BTU-inch per (hour) (sq ft) (deg F) at a mean temperature of 75 deg F and shall be suitable for duct velocities up to 5,000 FPM.

3. The liner shall have sound absorption coefficients as follows:

Frequency, Hertz	125	250	500	1000	2000	4000	NRC
Sound absorption coefficient	0.15	0.55	0.71	0.94	1.03	1.05	0.80

4. The indicated duct sizes are the airway dimensions of the duct system which does not include provisions for the duct liner; therefore, the Contractor shall add the duct liner thickness to the indicated duct sizes.

K. Manufacturers, or Equal

1. Manville Products Corporation, Linacoustic-HP
2. Owens-Corning

2.7 EQUIPMENT AND TANK INSULATION

A. Low Temperature Insulation

1. For equipment and tank insulation up to 250 deg F, use pipe insulation as described above.
2. The installation shall be in strict accordance with the manufacturer's recommendations.
3. An aluminum or PVC jacket shall be installed over the insulation for protection.

B. High-Temperature Insulation

1. High temperature insulation shall be utilized for equipment and tanks with surface temperatures up to 1200 deg F.

2. The high temperature insulation shall consist of 4-in thick calcium silicate or similar pre-molded blocks, constructed in 2 layers of 2-in thickness each, with staggered joints, and applied over a ¾-in high metal rib lath.

3. The inner layer shall be suitable for use up to 1200 deg F, and the second layer shall be suitable for use up to 1000 deg F.

4. Bends, voids, joints, fittings and other parts shall be filled with insulating cement.

5. Aluminum laggings shall be banded to the insulation in a similar fashion as indicated for standard insulation, and allowances shall be made for thermal expansion.

6. The insulation thickness shall be as recommended by the manufacturer of the equipment or tank.

C. Ductwork Insulation Manufacturer, or Equal

1. Owens Corning, Fiberglas All-Service Duct Wrap
2. Johns Manville, Type 150

PART 3 EXECUTION

3.1 GENERAL

A. Piping, fittings, and valves to be insulated shall be clean and dry prior to installation of insulation.

B. Piping indicated to be insulated shall be completely insulated inside structures, except where indicated otherwise.

3.2 INSULATION OF STRAIGHT DUCT AND FITTINGS

A. Before applying the duct wrap, air ducts shall be clean, dry and tightly sealed at joints and seams.

B. Portions of the duct designated to receive duct wrap shall be completely covered with duct wrap.

C. Remove a 2-in piece of insulation from the facing at the end of the piece of duct wrap to form an overlapping stapling and taping flap.

D. Install duct wrap insulation with facing outside such that the tape flap overlaps the insulation and facing at the other end of the piece of duct wrap.

E. Adjacent sections of the duct wrap insulation shall be tightly butted and overlapped with the 2-in stapling and taping flap.

F. If the duct is rectangular or square, install insulation such that it is not excessively compressed at corners.

G. Seams shall be stapled approximately 6-in on center, using ½-in steel outward clinching staples.

H. Seams and joints shall be sealed with pressure-sensitive tape matching the insulation facing (either plain foil or FRK backing stock) or glass fabric and mastic.

I. Cloth duct tape of color or finish using reclaimed rubber adhesives will not be accepted for use on duct wrap insulation.

J. Where rectangular ducts are 24-in or greater in width, the duct wrap insulation shall be additionally secured to the bottom of the duct with mechanical fasteners such as pins and speed clip washers, spaced on 18-in centers (maximum) to prevent the insulation from sagging.

K. Where a vapor retarder is indicated, seal tears, punctures and other penetrations of the duct wrap facing using one of the above methods to provide a vapor-tight system.

L. Damaged Insulation

1. The Contractor shall replace insulation that has been damaged or removed by modifications to the existing ductwork.

2. The replacement insulation shall be new and joints between new and existing insulation shall be made water-tight.

3.3 DUCTWORK INSPECTION

A. After completing the installation of the duct wrap and before operations are to commence, visually inspect the system and verify that it has been installed correctly.

B. Open system dampers and turn on fans to blow scraps and other loose pieces of material out of the duct system; allow for a means of removal of such material.

C. Check the duct system to ensure that there are no air leaks through joints.

3.4 FIBERGLASS INSULATION

A. Fiberglass insulation shall be securely held in place before the final covering is applied.

B. A scrim fabric, similar to a 20 x 10 thread count mesh and 100 percent fiberglass, shall be pasted in place to hold the pipe insulation securely to the pipe.

C. The scrim fabric shall be at least 4-in wide, with at least 2 applications per length of pipe insulation, and one at each joint.

3.5 JACKETING

A. Joints shall be neatly finished with no ragged ends.

B. When finished, the covering shall show no exposed staples or other binding used during installation.

C. Staples, if used, shall be stainless steel.

3.6 LAGGING FABRIC

A. The final lagging fabric shall be neatly pasted in place with a 3-in longitudinal overlap using a **Luben No. 9 adhesive**, or equal.

B. Each transverse joint shall have a 3-in butt strip of the same fiberglass fabric.

C. Final joints shall be neatly finished with no ragged ends and the covering shall present a neat, uniform surface when finished.

D. The fabric shall show no exposed staples or other binding used during construction; staples, if used, shall be stainless steel.

END OF SECTION

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SECTION 23 08 00 – COMMISSIONING OF HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Related Documents

1. Drawings and general provisions of the Subcontract apply to this Section.

2. Review these documents for coordination with additional requirements and information that apply to Work under this Section.

B. Section Includes:

1. General requirements that apply to implementation of commissioning of HVAC systems, assemblies and components.

C. Reference Specifications

Division 23	HVAC Sections

D. Reference Standards

Associated Air Balance Council (AABC)
National Environmental Balancing Bureau (NEBB)

1.2 REFERENCES

A. General

1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.

2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

1.3 DESCRIPTION

A. The purpose of commission is to ensure the Owner and Engineer that Work has been completed as specified and that systems are functioning in the manner as described in the design documents and specified system operating criteria. It will assist operating staff training and familiarization with new systems. It will serve as a tool to reduce post-occupancy critical systems operational difficulty or failure. It will, also, be used to develop test protocol and record the associated test data in an effort to advance the building systems from a state of substantial completion to a full dynamic operation.

B. Commission will commence after preliminary punch list items are completed by Subcontractors.

C. The steps associated with commissioning are outlined below:

1. Step One - Installation Verification
2. Step Two - System Start-Up.
3. Step Three - Functional Performance Testing.

D. Operational staff training is essential to the commission process and will run concurrently with steps one through three.

E. The Commissioning Team will include representatives of the Owner, Construction and Installing Subcontractors, Test and Balance Subcontractor, Temperature Controls Subcontractor and Construction Subcontractor's Commissioning Agent. Equipment manufacturer's representatives will be present for start-up as specified in the equipment Specification Sections and for equipment training.

1.4 SYSTEMS TO BE COMMISSIONED

A. Commissioning will be performed on the following systems:

1. Controls System
2. Air Conditioning Equipment.
3. Central Supply and Return Air Systems.
4. Air Terminals.
5. Smoke Detection (HSSD) System

1.5 SUBMITTALS

A. Commissioning Plan as prepared by the prime Subcontractor or his Commissioning Agent.

B. Prime subcontractors or his Commissioning Agent shall provide Functional Performance Tests (FPT) procedures for the above listed systems. Prime subcontractors or his Commissioning Agent shall provide system narrative descriptions as part of the FPT procedures.

PART 2 PRODUCTS

2.1 COMMISSIONING PLAN

A. The commissioning plan shall outline the organization, scheduling, team members, and documentation pertaining to the overall commissioning process.

2.2 NARRATIVE DESCRIPTIONS

A. A narrative description of the design intents of the systems and their intended modes of sequences of operation.

2.3 FUNCTIONAL PERFORMANCE TESTS (FPT) PROCEDURES

A. The FPT procedures at the minimum shall consist of the following Sections:

1. Narrative Description:

a. This Section provides a narrative description of the design intents of the systems and their intended modes of sequences of operation.

2. Testing Prerequisites:

    a. This Section contains verification that primary mechanical, electrical, and controls systems that support or interact with the system that the FPT is prepared against are completed, tested and operational.

3. Installation Verification:

    a. This Section contains verification that the system installation is completed and is ready for commissioning.

4. Commencement of Functional Performance Testing:

    a. This Section records the date and time of the start of system commissioning.

5. System Condition Prior to Staring Performance Testing:

    a. This Section records the current set points and parameters of the system at the start of commissioning.

6. Functional Performance Test:

    a. This Section shall provide the following:

        1) Sequential steps required to set parameters and conditions required to test component and functions throughout intended ranges of operation.

        2) Full range of checks and tests carried out to determine if electric and pneumatic connections, components, subsystems, systems and interfaces between systems function in accordance with the contract documents and design intents.

        3) All modes and sequences of control operations, interlocks and conditional control responses and specified responses to abnormal emergency conditions.

7. End of Functional Performance Test:

    a. This Section records the date and time of the end of system commissioning.

8. Field Notes:

    a. This Section records notes or remarks during system commissioning.

9. List systems modifications, not required by the Contract Documents, but provided by the Subcontractor. List other questions regarding such system modifications.

10. List problems discovered during Commissioning that were corrected.

11. List problems discovered during Commissioning that were not corrected.

12. List recommended party that should take action on these problems.

2.4 COMMISSIONING OF HVAC VRF/VRV SYSTEMS

A. VRF/VRV SYSTEM SUMMARY

a. A. Section includes commissioning process requirements for HVAC VRF systems, assemblies, and equipment. The Commissioning agent shall be a third party sub-contractor. That represents the equipment manufacture. He/she shall not be an employee of the Mechanical Contractor and be an Certified Building Commissioning Professional (CBCP)

b. VRF/VRV SYSTEM DEFINITIONS

1) Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

2) CxA: Commissioning Authority.

3) HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.

4) Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

c. VRF/VRV SYSTEM INFORMATIONAL SUBMITTALS

1) Certificates of readiness.
2) Certificates of completion of installation, prestart, and startup checklists.
3) LATS Drawings

d. VRF/VRV SYSTEM ALLOWANCES

1) Labor, instrumentation, tools, and equipment costs for technicians for the performance of commissioning testing are covered by a coast worked into the total equipment price.

e. VRF/VRV SYSTEM Contractor’s RESPONSIBILITIES

1) Perform commissioning tests at the direction of the COMMISSIONING AUTHORITY (CxA) or owners representative.

2) Provide information requested by the (CxA) for final commissioning documentation.

f. VRF/VRV SYSTEM (CxA) COMMISIONING AUTHORITY RESPONSIBILITIES

1) Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC VFR systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

2) Direct commissioning testing.

3) Verify system components are installed per the installation instructions

4) Provide Field inspection reports

5) Provide job site progress pictures

g. VRF/VRV SYSTEM COMMISSIONING DOCUMENTATION

1) Provide the following information to the (CxA) for inclusion in the commissioning plan:

2) Plan for delivery and review of submittals, systems manuals, and other documents and reports.

3) Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.

4) Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC systems, assemblies, equipment, and components to be verified and tested.

5) Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.

6) Certificate of readiness certifying that HVAC VRF systems, subsystems, equipment, and associated controls are ready for testing.

7) Test and inspection reports

8) Corrective action documents.

9) Verification of testing, adjusting, and balancing reports.

10) The installing contractor and all their installers are to be certified by the equipment manufacturer for the installation of variable refrigerant flow systems.

h. VRF/VRV SYSTEM TESTING PREPARATION

1) Certify that HVAC VRF systems, subsystems, and equipment have been installed, Per the installation instructions.

2) Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

i. VRF/VRV SYSTEM TESTING AND BALANCING VERIFICATION

1) Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the (CxA).

2) Notify the (CxA) at least 10 days in advance of testing and balancing Work, and provide access for the (CxA) to witness testing and balancing Work.

3) Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC systems at the direction of the (CxA)

4) The Equipment provider is to provide factory authorized start-up service

5) Successful variable refrigerant flow equipment vendor is to perform periodic site visits to field verify installation is within standards as outlined by the equipment manufacturer. Equipment vendor is to document variance from manufacturer installation guidelines and facilitate correction with the mechanical contractor prior to start-up. Site visits are to be carried out at minimum on a bi-weekly visit.

6) The ((CxA) will notify testing and balancing Subcontractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.

7) The testing and balancing Subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.

j. HVAC VRF/VRV SYSTEMS EQUIPMENT TESTING PROCEDURES

1) Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the (CxA).

2) Scope of HVAC VRF/VRV testing shall include entire HVAC VRF/VRV installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space.

3) Tests will be performed using design conditions whenever possible.

4) Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the (CxA) and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

5) The (CxA) may direct that set points be altered when simulating conditions is not practical.

6) If tests cannot be completed because of a deficiency outside the scope of the HVAC system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

7) HVAC VRF/VRV Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in the manufacturer`s installation instructions" Assist the (CxA) with preparation of testing plans.

2.5 COMMISSIONING OF HVAC VRF/VRV SYSTEMS

A. Summary

1. Section includes commissioning process requirements for HVAC VRF systems, assemblies, and equipment. The Commissioning agent shall be a third party sub-contractor. That

represents the equipment manufacture. He/she shall not be an employee of the Mechanical Contractor and be an Certified Building Commissioning Professional (CBCP)

B. Definitions

1. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

2. CxA: Commissioning Authority.

3. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.

4. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

C. Informational Submittals

1. Certificates of readiness.
2. Certificates of completion of installation, prestart, and startup checklists.
3. LATS Drawings

D. Allowances

1. Labor, instrumentation, tools, and equipment costs for technicians for the performance of commissioning testing are covered by a coast worked into the total equipment price.

E. Contractor's Responsibilities

1. Perform commissioning tests at the direction of the COMMISSIONING AUTHORITY (CxA) or owners representative.

2. Provide information requested by the (CxA) for final commissioning documentation.

F. (CxA) Commissioning Authority Responsibilities

1. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC VFR systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

2. Direct commissioning testing.

3. Verify system components are installed per the installation instructions

4. Provide Field inspection reports

5. Provide job site progress pictures

G. Commissioning Documentation

1. Provide the following information to the (CxA) for inclusion in the commissioning plan:

2. Plan for delivery and review of submittals, systems manuals, and other documents and reports.

3. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.

4. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC systems, assemblies, equipment, and components to be verified and tested.

5. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.

6. Certificate of readiness certifying that HVAC VRF systems, subsystems, equipment, and associated controls are ready for testing.

7. Test and inspection reports

8. Corrective action documents.

9. Verification of testing, adjusting, and balancing reports.

10. The installing contractor and all their installers are to be certified by the equipment manufacturer for the installation of variable refrigerant flow systems.

H. Testing Preparation of VRF/VRV System

1. Certify that HVAC VRF systems, subsystems, and equipment have been installed, Per the installation instructions.

2. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

I. Testing and Balancing Verification of VRF/VRV System

1. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the (CxA).

2. Notify the (CxA) at least 10 days in advance of testing and balancing Work, and provide access for the (CxA) to witness testing and balancing Work.

3. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC systems at the direction of the (CxA)

4. The Equipment provider is to provide factory authorized start-up service

5. Successful variable refrigerant flow equipment vendor is to perform periodic site visits to field verify installation is within standards as outlined by the equipment manufacturer. Equipment vendor is to document variance from manufacturer installation guidelines and facilitate correction with the mechanical contractor prior to start-up. Site visits are to be carried out at minimum on a bi-weekly visit.