3.02 INSTALLATION OF EMBEDDED ITEMS

A. General:

1. The Contractor shall notify all trades when construction is ready for the setting of anchor bolts, inserts, sleeves, and other built-in equipment, in order that such material shall be set at the proper time. Before placing concrete, care shall be taken to determine that all items to be embedded in concrete are accurately located, firmly secured in place and protected from damage or displacement until securely held by the concrete.
2. All items shall be thoroughly cleaned, free from rust, scale, dirt, grease or other coating. Any wood used for removable keys shall be thoroughly dampened before concrete is placed against the wood. The Contractor shall be responsible for any displacement of the items caused by his workmen.

B. Subject to specific approval by the engineer, electrical conduit may be embedded in concrete according to the provisions of Article 6.3 of ACI 318 "Building Code Requirements for Reinforced Concrete", provided the following conditions are met:

1. Outside diameter of conduit shall not exceed 1/4 of concrete thickness.
2. Conduit shall not be placed closer than three diameters on center.
3. Conduit shall not be embedded in structural concrete slabs less than six inches thick.
4. A 4-inch minimum concrete cover shall be provided for conduits in structural concrete slabs from the top of slab to top of pipe and from the bottom of slab to the bottom of pipe.
5. Conduit shall not be located between bottom of reinforcing steel and bottom of concrete slab.
6. At pipes parallel to bearing walls or beams, the minimum clear distance from the face of wall or beam to the face of pipe shall be 18 inches.
7. Conduit is generally not permitted in beams or girders.
8. Aluminum conduit shall not be embedded in concrete.
9. Adjacent conduits shall be spaced at least 12 inches apart.

3.03 REMOVAL

A. Form Removal:

1. Forms shall be removed in a manner to insure complete safety of the structure. In no case shall supporting forms or shoring of slabs, beams, or other suspended members be removed until members have acquired sufficient strength to support safely their weight and the load thereon.
    A. Do not remove shores supporting beams and slabs until concrete has attained at least 85% of the specified compressive strength.
2. Care shall be taken to avoid spalling the concrete surface and to assure that newly unsupported portions of the structure are not subjected to heavy construction or material loading. Additional shores or reshores shall be provided, as required, to adequately support the members during the construction period.
3. All responsibility involved in the removal of forms, shores, and bracing shall rest with the Contractor, and he shall be solely responsible for accidents to persons and property of any nature.

B. All parts of removed forms reserved for reuse shall be inspected, cleaned and repaired. Any part or panel which has been dented, deformed or otherwise rendered unfit for reuse shall be removed from the site at once.

C. Tie-rod clamps to be entirely removed from the wall shall be loosened 24 hours after concrete is placed, and form ties may be removed at that time. Filling of form tie holes shall be as specified in Section 03345, Concrete Placing, Curing and Finishing.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SCOPE

A. The work of this Section includes all labor, materials, tools and equipment necessary for the fabrication, transportation and installation of all reinforcing steel necessary for the proper completion of the Work.

1.02 SUBMITTALS

A. Shop drawings, brochures and samples shall be submitted for all items to be furnished in accordance with the provisions of Section 01300.

B. Submittals required under this section include, but are not limited to the following:
   1. Certified mill reports of reinforcing steel identifying chemical and physical analysis.
   2. Submit fully detailed shop drawings, conforming to the Manual of Standard Practice for Detailing Reinforced Concrete Structures, ACI 315 showing and including, but not limited to the following:
      a. Sizes and dimensions for fabrication and placing of reinforcing steel and bar supports.
      b. Bending schedules and diagrams.
      c. Splices and laps.
      d. Assembly diagrams.
      e. Reinforcing steel clearances.
      f. Class designation and details of bar supports.
      g. Pertinent concrete details with dimensions and elevations.
      h. Items furnished by mechanical trades or under other sections of the Specification to be cast in concrete where interference may occur.
      i. Reinforcement of concrete walls shall be shown on wall elevations with required sections, reinforcement of beams on beam elevations with required sections and reinforcement of floor and roof slabs on plan views with required sections.

1.03 PRODUCT HANDLING

A. Deliver reinforcement to project site in bundles bearing tags indicating size, length and identification mark. Each bundle, roll or individual bar shall be so labeled.

B. Classify and stack materials off the ground to prevent contamination and to facilitate subsequent inspection and handling.

1.04 TECHNICAL REQUIREMENTS

A. The concrete reinforcing work included in this contract has been designed in accordance with the American Concrete Institute's "Building Code Requirements for Structural Concrete" (ACI-318), “Specifications for Tolerances for Structural Concrete” (ACI 117), and the Concrete Reinforcing Steel Institute “Manual of Standard Practice”, .

B. Reinforcing shall be performed in accordance with the applicable provisions of the building code of the state wherein the work is done and any local codes or ordinances having jurisdiction over the work.

C. In addition, the various ASTM, ACI, Department of Commerce, and Federal Specifications cited throughout this section are hereby included by reference.

PART 2 PRODUCTS

2.01 STEEL REINFORCEMENT

A. General: The term "steel reinforcement" shall include all bars, tendons, anchorage, hooks, stirrups, dowels, ties, tie-wire, chairs and spacers noted on the Drawings, and/or specified herein, and evidently required. The types and grades of reinforcing required are specified herein.

B. Materials:
1. Reinforcing Bars: Shall be formed of new billet steel conforming to ASTM A615, Grade 60 except as otherwise noted.
2. Welded Wire Fabric: Shall conform to ASTM A185 of the sizes indicated. For slabs, flat sheets only shall be used, and rolls will be unacceptable.
3. Tie Wire:
   a. For Structural Concrete: FS QQ-W-461 annealed black, 16 gauge minimum.
4. Bar Supports:
   a. Chairs, bolsters spacers and other devices to properly position reinforcing steel shall conform to "Bar Support Specifications" CRSI Manual of Standard Practice and shall be of adequate strength and approved design to prevent displacement of reinforcing and to prevent discoloration of concrete.
   b. Support devices shall be Class A, except where concrete surfaces are exposed to view, weather or moisture; support devices shall be Class C - Plastic Protected.
   c. For slabs on grade, supports shall be precast concrete blocks. Precast concrete blocks shall be not less than 4 inches square and shall have compressive strength equal to that of the surrounding concrete. The maximum spacing for welded wire fabric supports shall be 36 inches. The use of lifting hooks to support welded wire fabric is prohibited.

C. Fabrication:
1. Steel reinforcement shall be fabricated to the shapes, sizes and dimensions as shown on the drawings, details and schedules. All bending of bars and stirrups shall be in accordance with the requirements set forth in the Manual of Standard

Practice of the Concrete Reinforcing Steel Institute. All steel shall be bent cold and shall not be bent or straightened in a manner that will injure the metal. Bars with kinks or bends not so detailed shall not be used.

2. Bends for stirrups and ties shall be made around a pin having a diameter not less than four times the minimum thickness of the bar but in all cases the diameter of bend shall be at least large enough to accommodate the supporting bar. Bends for other bars shall be made around a pin having a diameter not less than six times the minimum thickness of the bar, except that for bars larger than one inch the pin shall be not less than eight times the minimum thickness of the bar.

PART 3 EXECUTION

3.01 INSTALLATION

A. Reinforcing Bars:

1. Placing Reinforcement:
   a. Reinforcement shall be accurately placed in accordance with the drawings and adequately secured in proper position by concrete or metal chairs or spacers which will ensure accuracy of position, both horizontally and vertically and will be sufficiently rigid to prevent displacement of the reinforcement during the placing and working of the concrete.
   b. Reinforcement steel shall be securely tied at intersections with tie wire or clips and shall be supported in a manner that will keep all metal away from exposed concrete surfaces.
2. Splices:
   a. All splices in the reinforcement shall be as shown on the drawings. The lapped ends of the bars shall be either separated sufficiently to allow the embedment of the entire surface of each bar in concrete, or connected as a single continuous bar to develop the full strength of the bar.
   b. Splicing shall not be made at the points of maximum stress, nor shall adjacent bars be spliced at the same points. Splices shall be staggered.
   c. When permitted by written approval of the Engineer, welding shall be in accordance with AWS 12.1.
3. All reinforcement in any one section shall be placed, supported and secured before the beginning of concrete operations. Unless otherwise indicated on the Drawings, the details of reinforcing steel, including bending, splicing and supporting shall conform to ACI Building Code 318 and Detailing Manual 315.
4. Steel Adjustment:
   a. Move within allowable tolerances to avoid interference with other reinforcing steel, conduits or embedded items.
   b. Do not move bars beyond allowable tolerances without approval of the Engineer.
   c. Do not heat bend or cut bars without approval of the Engineer.

B. Wire Fabric:

1. Install in longest practicable sheet.
2. Lap adjoining pieces one and one-half mesh minimum and wire securely together.
3. Offset end laps in adjacent widths to prevent continuous laps.

C. Cleaning: All reinforcement, when concrete is placed shall be entirely free from flaking rust, loose mill scale, grease, dirt or other coating which would destroy or reduce its bond with the concrete. Reinforcing shall be wire brushed before placing concrete if the Engineer deems it necessary.

D. Relation of Bars to Concrete Surfaces:
1. The minimum cover of concrete for all reinforcement shall conform to the dimensions shown on the Drawings, which indicate the clear distance from the edge of the reinforcement to the concrete surface.
2. Where not otherwise shown, the minimum coverage of the concrete in inches over the steel shall be as follows:

MEMBER	EXPOSED TO		
	Air	Weather & Air Over-Liquid	Earth & Liquid
Footing	--	--	3
Wall, Column or Beam	1-1/2	2	2(b)
Slab Top	1	2	2
Slab and Joist Bottom	1	2	2(b)

a. Applicable to all cast in place concrete except as otherwise shown on the drawings.
b. Increase one inch when cast against earth.

E. Observation of Reinforcing Steel:
1. Notify the Engineer at least 48 hours before placing concrete. All reinforcing within limits of one day's concrete placement must be tied in place and reviewed by the Engineer prior to placing concrete.

F. Protection During Concreting:
1. Keep reinforcing steel in proper position during concrete placement.
2. Dowels, projecting above or adjacent to exposed concrete surfaces shall be protected by means of a waterproof cover, a thin coating or neat cement slurry, or a coating of a zinc rich compound having 95 percent zinc in the dried film.

END OF SECTION

SECTION 03250

CONCRETE ACCESSORIES

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide concrete accessories as required by the Contract Documents.
   1. In general the work of this Section includes all labor, materials, tools and equipment necessary for furnishing and installing water stops, joint fillers and vapor barriers as specified herein, as shown on the Drawings or as necessary for the proper completion of the work.

1.02 SUBMITTALS

A. Shop drawings, brochures and samples shall be submitted for all items to be furnished in accordance with the provisions of Section 01300.

B. Submittals required under this section include, but are not limited to the following:
   1. Brochures and technical data:
      a. Waterstops
      b. Pre-formed joint filler
      c. Vapor barrier
      e. Cartridge injection adhesive anchors
      f. Capsule anchors
   2. Samples:
      a. Waterstops
      b. Pre-formed joint filler

1.03 PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed in such a manner as not to degrade quality, or serviceability.

PART 2 PRODUCTS

A. PVC Waterstops:
   1. PVC waterstops shall be manufactured from virgin polyvinyl chloride plastic compound meeting Corps of Engineers Specifications CRD-C572 except that tensile strength shall be greater than 2,000 psi, minimum ultimate elongation shall be 300 percent and no scrap, reclaimed material or pigment shall be contained, therein. A notarized certificate shall be submitted attesting to the above requirements.
      a. Waterstops for construction joints and control joints shall be 6 inch wide, ribbed, flat, and shall be Greenstreak 679, or an approved equal.
      b. Where noted on the Drawings or required because of conflicts, labyrinth waterstop shall be used. Labyrinth waterstop shall be Greenstreak 789 and 790, or approved equals.

B. Preformed Joint Filler:
   1. Cork joint filler shall conform to ASTM 1752, Type II as manufactured by W.R. Meadows Inc.

C. Vapor Barrier Membrane:
   1. 15 mil thickness complying with ASTM E1745, Class A, B, and C, Stego Wrap or approved equal.

E. Cartridge Injection Adhesive Anchors: Threaded steel rod, inserts or reinforcing dowels, complete with nuts, washers, polymer or hybrid mortar adhesive injection system, and manufacturer's installation instructions. Type and size as indicated on Drawings.
   1. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel threaded rods conforming to ASTM A36, ASTM A 193 Type B7 or ISO 898 Class 5.8 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
   2. Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 316 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
   3. Reinforcing dowels shall be A615 Grade 60.
   4. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following:
      a. Provde carbon steel, ASTM F1554 grade 36, 50 or 105 inc plated anchor rods as directed by the Engineer with Simpson SET-3G High-Strength Epoxy Adhesive System for anchorage to concrete, per ICC-ESAC308.

F. Capsule Anchors: Threaded steel rod, inserts and reinforcing dowels with 45 degree chisel point, complete with nuts, washers, glass or foil capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, and manufacturer's installation instructions. Type and size as indicated on Drawings.
   1. Interior Use: Unless otherwise indicated on the Drawings, provide chisel-pointed carbon steel rods conforming to ASTM A36, ASTM A 193 Type B7 or ISO 898 Class 5.8 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
   2. Exterior Use: As indicated on the Drawings, provide chisel-pointed stainless steel anchors. Stainless steel anchors shall be AISI Type 316 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
   3. Reinforcing dowels shall be A615 Grade 60, with 45-degree chisel-points at embedded end.

PART 3 EXECUTION

A. PVC Waterstops and Expansion Joints:

1. Shall be used on all below grade construction joints and wherever noted on the Drawings or required to make construction joints watertight.
2. Waterstops shall be protected from the elements if stored for long periods of time.
3. All waterstops shall be positively held from displacement during concrete placement.
    a. Waterstop shall be securely fastened to formwork or reinforcing steel with wire ties every 12 inches on both edges prior to concrete placement.
4. Waterstops shall be complete and continuous throughout.
    a. Factory formed and tested corners and intersections shall be used.
5. All splices and connections shall be made with a thermostatically controlled electric splicer.
    a. The finished splice and connections shall have a tensile strength of not less than eighty (80) percent of the unspliced section.
6. No holes will be permitted in waterstop. Use hog rings for all waterstops.

B. Hydrophilic Water Sealing Materials:
1. Hydrophilic waterstop shall be installed in strict accordance with the manufacturer's instructions except as otherwise specified herein.
    a. Install the waterstop continuously in double strips (laid side by side) in each joint.

C. Pre-Formed Joint Filler:
1. Attach to surfaces with a bonding agent compatible with the joint sealant and joint filler.
2. All butt splices shall be taped to prevent the intrusion of the second placement of concrete into the joint.

D. Vapor Barrier:
1. Place on prepared base as shown on the Drawings.
2. Comply with ASTM E 1643.
3. All seams to be lapped a minimum of six (6) inches.
4. All tears and punctures shall be repaired and taped tight.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required for the concrete work and, where appropriate, applying or installing such materials for the various items of concrete work as shown on the Drawings, as specified herein, and evidently required.

B. Codes and Standards:
   1. The concrete work included in this contract has been designed in accordance with the American Concrete Institute's "Building Code Requirements for Reinforced Concrete" (ACI 318).
   2. The ACI Standards "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete" (ACI 211.1) and "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete" (ACI 304) are also hereby made a part of this specification insofar as they apply and do not conflict with the provisions of this specification or any local codes or ordinances having jurisdiction over the work. In addition, the various ASTM, ACI, Department of Commerce, and Federal Specifications cited throughout this section are hereby included by reference. Concrete work shall be performed in accordance with the applicable provisions of the building code of the state wherein the work is done.

C. Strength:
   1. All concrete shall be designed to have a minimum 28 day compressive strength as follows:
      a. Interior floor slabs and beams: 4,000 psi.
      b. Exterior slabs, foundations, columns, walls, and base mats for concrete water containment: 4500 psi.
      c. Mud slab - 3000 psi

D. Contractor may use a low shrinkage concrete mix with crack-reducing admixtures as recommended by the admixture manufacturer, if submitted and approved by the Engineer, at no additional cost to the Owner. If the alternate concrete mix is submitted for approval, the Contractor shall still comply with the spacing requirements between construction joints as noted on the Drawings. Construction joints are indicated on the drawings. Alternative construction joint locations may be submitted on a drawing prepared and stamped by a structural engineer licensed in the Commonwealth of Massachusetts for approval, at no additional cost to the Owner.

1.02 SUBMITTALS

A. Shop drawings, brochures and samples shall be submitted for all items to be furnished in accordance with the provisions of Section 01300.

B. Submittals required under this section include, but are not limited to the following:

1. Concrete Mix Design: Submit proposed design mixes for each different type and strength of concrete to be used. Provide separate mix designs for any change in ingredients. Include the following items:
    a. Mix proportions for all ingredients of the mix. Designate within the submittal where each mix is proposed to be used. Proportions shall be established by one of the following methods in accordance with ACI 301.
        i. Field experience.
        ii. Trial batch
        iii. Water/cement ratios specified herein.
    b. Cement type.
    c. Aggregate gradations taken within 3 months from the date of submission. Specify size of coarse aggregate in accordance with ASTM size numbers. Blended coarse aggregates shall have a combined gradation complying with an ASTM designation.
    d. Product data for all proprietary items incorporated into the mix including, but not limited to admixtures.
    e. Compressive strength results from an independent testing laboratory for mixes designed in accordance with trial batch or field experience methods.
    f. Trial batches shall be tested within 24 months from the date of submission.
    g. Submit quantity of tests in accordance with ACI 301. Note that mix designs developed in accordance with the field experience method must include a minimum of 30 consecutive tests, with an allowance for 10 to 30 consecutive tests with a higher average strength. All tests must be performed within 24 months of the submission date to be included in standard deviation and average strength calculations.
    f. Slump and air content shall be consistent with specifications for this project within tolerances specified within ACI 301.
    g. Test reports for trial batch or field experience submissions shall identify the source of cement and aggregates.
2. Certified mill reports of cement.
3. Manufacturer Certification: Submit verification of the certification of the concrete supplier for compliance with Manufacturer's Certification as specified herein.

1.03 PRODUCT HANDLING

A. It is intended that the concrete be supplied from a commercial ready-mix plant capable of meeting the following requirements for storage and handling of materials in this specification. Where no such plant exists within a reasonable distance from the site, and for small amounts of concrete which may be site mixed, the following requirements shall apply.
    1. Cement shall be carefully stored immediately upon receipt. Cement in sacks shall be stored in a suitable weatherproof structure which shall be as airtight as practical to prevent the absorption of moisture. Sacks shall be stacked close together to reduce circulation of air but shall not be stacked against outside walls. The manner of storage shall permit easy access for inspection and identification of each shipment. Bulk cement shall be transferred to elevated airtight and weatherproof bins. At the time of use, all cement that has been in storage so long that there is doubt of its quality will be tested by standard mortar to determine its suitability for use, and such cement shall not be used without approval.
    2. Aggregates shall be stored in a manner that will preclude the inclusion of foreign material. Aggregates of different sizes shall be stored in separate piles. Stockpiles

of coarse aggregate shall be built in horizontal layers not exceeding four feet in depth to avoid segregation.

1.04 TESTING AND INSPECTION

A. General:

1. All construction testing and inspections will be conducted parties employed by the Owner. The contractor shall provide ample notice prior to each concrete placement to permit inspection of reinforcing steel, forms, mixing, and placement. Any concrete placed without prior inspection will be rejected unless otherwise approved in writing.
2. Concrete materials and operations shall be tested and inspected as the work progresses. Failure to detect any defective work or material shall not in any way preclude later rejection when such defect is discovered, nor shall it obligate the Engineer for final acceptance.
3. The use of testing services shall in no way relieve the Contractor of the responsibility to furnish materials and construction in full compliance with the contract documents.

B. Responsibilities and duties of General Contractor:

1. Ingredient Tests: Prior to making design mixes, the Testing Laboratory conforming to ASTM E329 and subject to the approval of the Engineer shall conduct the following tests in accordance with the procedures referred to in the applicable Reference Standards, cited herein, to assure conformance with the applicable Specifications.
   a. Cement: Specific gravity and brand name of cement.
   b. Aggregates: Sieve analysis, specific gravity, soundness, percentage of voids, absorption, potential reactivity, moisture content of fine and coarse aggregate, dry-rodded weight of coarse aggregate, and fineness modulus of fine aggregate.
2. Design Of Concrete Mixes:
   a. Trial Batch Method: The testing laboratory shall recommend, as determined by trial mixes and strength curves, the design mixes to be used for each application of concrete that will produce concrete of specified strengths and finishes with slumps and workability to meet all placing conditions.
   b. Design mixes shall indicate water-cement ratio, cement factor, water content, admixture content, cement content, aggregate content, aggregate gradations, slump, air content and strength. Design mixes and related tests shall be in accordance with the procedures referred to in the applicable reference specifications cited herein.
   c. Reference Standards: Concrete mixes shall be designed in accordance with Article 4.2.3 of Chapter 4 of ACI 301 “Specifications for Structural Concrete Buildings” and references referred to therein.
   d. When acceptable data is not available for either field experience or trial batch design methods, provide normal weight concrete with the following properties:
      i. 4000 psi 28-day compressive strength; water-cement ratio, 0.44 maximum (non-air entrained).
      ii. 4500 psi 28-day compressive strength; water-cement ratio, 0.35 maximum (air entrained).

iii. 3000 psi 28-day compressive strength; water-cement ratio, 0.58 maximum (non-air entrained).

e. Limit of Changes for Pumping: If the Contractor elects to convey concrete by pumping, the established job mix may not be altered by more than the following:

Cement	plus 20 pounds per cubic yard
Fine Aggregate	plus 50 pounds per cubic yard
Coarse Aggregate	minus 50 pounds per cubic yard

f. Any conveying method requiring a greater increase in FA/CA ratio will not be approved.

3. Sampling of Concrete:
   a. Samples of concrete for air, slump, unit weight, and strength tests shall be taken in accordance with ASTM C172.
   b. During each concrete placement, the testing agency and its certified testing laboratory shall prepare test concrete cylinders. One set of 4 cylinders each shall be taken for each 100 cubic yards, or fraction thereof, of each mixture design of concrete placed in any one day. When the total quantity of concrete with a given mixture design is less than 20 cubic yards, the strength tests may be waived by the Engineer if, in his judgement, adequate evidence of satisfactory strength is provided, such as strength test results for the same kind of concrete supplied on the same day and under comparable conditions to other work. Cylinders shall be delivered to the testing labs within 24 hours. One cylinder shall be tested at 7 days and two at 28 days. The fourth cylinder shall be saved for a 56-day break should the average of the 28-day results not achieve the specified strength. An electronic PDF copy of the test results shall be submitted to the Engineer directly by the laboratory for review. In any case where the strength of the cylinders fail to meet the criteria of ACI 318, Chapter 26, Section 26.12, the Engineer shall have the right to order the defective concrete removed and proper concrete put in its place or to take such other action as they deem necessary to remedy the situation.
   c. The concrete used shall have a maximum slump as herein specified unless otherwise directed by the Engineer. Slump shall be determined as per ASTM C143. Slump tests shall be taken by the testing lab for each set of cylinders taken, whenever the testing agent observes a change in consistency, and at a minium interval of one test per 30 cubic yards.
   d. Air Content: Test for air content shall be performed in accordance with ASTM C173 or ASTM C231. Testing for air content shall occur in conjunction with each slump test.
4. Furnish necessary labor to assist the testing laboratory and the field observers in obtaining and handling samples at the project or other sources of materials.
5. Advise the Engineer and the field observers at least 24 hours in advance of placing concrete to allow for completion of quality tests and for the assignment of personnel.
6. Provide and maintain adequate facilities for safe storage and proper curing of concrete test specimens on the project site for the first 24 hours as required by ASTM C31, Article 7.2.
7. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

a. Manufacturer certified according to NRMCA's "Certification of Ready-Mixed Concrete Production Facilities".

8. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

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

a. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

i. Contractor's superintendent.
ii. Independent testing agency responsible for concrete design mixtures.
iii. Ready-mix concrete manufacturer.
iv. Concrete subcontractor.
v. Testing agency responsible for field quality control.
vi. Structural Engineer of Record.
vii. Special Inspector.

1.05 APPROVALS

A. Commencement of Work: Concrete work shall not begin until test results and design mixes have been approved by the Engineer.

B. Mix Variations: The Engineer reserves the right to vary in the field any previously approved design mix so as to compensate for field variables including but not limited to weather conditions, placing conditions, variations in size, gradation or characteristics of aggregate and end use of the concrete.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. General:

1. All concrete used in the work shall be composed of Portland Cement, fine and coarse aggregate, and admixtures as specified herein. Concrete for every part of the work shall be of a homogeneous structure which, when cured and hardened, will have the required strength and resistance to weathering.
2. The proportions of aggregate to cement for any concrete shall be such as to produce a mixture of the required strength which will work readily into the corners and angles of the forms and around reinforcement and that will produce finishes acceptable to the Engineer but without permitting the materials to segregate.

B. Cement: Cement shall meet the requirements of ASTM C150, Type II. Brands of cement shall be subject to the approval of the Engineer. Use one brand of cement throughout the project for each strength and mix of concrete. Substitution of one the following supplementary cementitious materials for a portion of the Portland Cement is acceptable, subject to percentage limitations specified:

1. Fly Ash: ASTM C618, Class C or F. 25% maximum substitution.

2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120. 50% maximum substitution.

C. Aggregate:
1. All aggregates shall conform to the standard specifications for Concrete Aggregates, ASTM C33, Class S.
2. Fine Aggregates:
a. Fine aggregates shall consist of sand or screenings of gravel or crushed stone, well graded from fine to coarse; clean and free from soft particles, clay, loam or organic matter, with the volume removed by sedimentation not more than three percent. When tested in accordance with ASTM C40 for organic impurities, the color of the supernatant liquid above the test sample shall show not darker than organic plate No. 1.
b. Fine aggregate shall not have more than 45 percent retained between any two consecutive sieves of those listed above, and its fineness modulus shall not be less than 2.3 nor more than 3.1. If the fineness modulus varies by more than 0.20 from the value assumed in selecting proportions for concrete, the fine aggregate shall be rejected unless suitable adjustments are made in concrete proportions to compensate for the difference in grading.

3. Coarse Aggregates:
a. Coarse aggregates shall consist of crushed stone or washed gravel having clean, hard, durable, uncoated particles, free from dust, dirt, or other deleterious substances; and free from thin, flat or elongated particles. The test for organic impurities specified for fine aggregate shall also apply to coarse aggregate. Maximum size shall be 3/4-inch for all concrete 8 inches and less in thickness. For heavier walls, footings and mass concrete, the maximum size may be increased to 1-1/2 inch, provided the space between the reinforcing bars therein is 1-1/3 greater than the maximum aggregate size.
b. Coarse aggregate shall conform to the grading given in Table 2 of ASTM C33 for sizes No. 467, 57, 67, 7, and 8.
c. For blended coarse aggregates, the above requirements pertain to the blend.

D. Water: Water shall be clean, potable, fresh and free from oil, acid, salt, alkali, sewage, organic matter, and other deleterious substances, complying with ASTM C94/C94M

E. Admixtures: Admixtures may be used where approved. The use of products other than those named herein will be allowed only with the written approval of the Engineer. All admixtures must be specifically identified in approved mix designs. Optional admixtures are not permitted. Changes to admixtures require resubmittal of the mix design before implemented. Admixtures shall be used as follows. The use of products other than those named herein will be allowed only with the written approval of the Engineer.
1. Air Entraining Agent: The air entraining admixture shall be a chloride free, purified and modified salt of a sulfonated hydrocarbon resin in liquid form conforming to ASTM C260.
2. Water Reducing Agents: Except when otherwise ordered by the Engineer or noted elsewhere herein, all normal structural concrete shall have a water reducing agent added. The admixture shall be a salt of lignosulfonic acid in liquid form

conforming to ASTM C494, Type A. The air entraining action of the water reducing agent shall be taken into account and the air entraining agent limited accordingly.

3. Water Reducing-Retarding Agents: When the ambient temperature rises above 70 degrees F., the water reducing agent shall be replaced in whole or in part with a water reducing-retarding agent conforming to ASTM C494, Type D. The admixture shall be used in such amounts as will produce concrete with a set time equal to that which it would have at 70 degrees F. without the retarder.
4. Set Accelerator: Where a set accelerator is allowed under the provisions of Section 03345 Concrete Placing, Curing, and Finishing, it shall be non-chloride conforming to ASTM C494, Type C and Type E.
5. Superplasticizer: Superplasticizing admixtures used to produce flowing concrete may be approved for use in concrete in any part of the structure. The dosage rate depends on the slump of the base concrete which should be kept constant and low (2-1/2 to 3 inches). Superplasticized concrete can lose slump in 60 to 90 minutes, or sooner if temperature is above 70 degrees F, therefore the admixture should be added to the mix at the project site if there is a probable combination of long concrete haul and warm temperature during placing operation. Otherwise the admixture should be added in accordance with the manufacturer's instruction.
6. Crack-Reducing Admixture: Crack-Reducing Admixtures may be used to reduce the magnitude of drying shrinkage, minimize the potential for cracking, and reduce joint spacing between concrete pours of large structures. Apply admixture at the dosage rate recommended by the manufacturer. Crack-Reducing Admixture shall be MasterLife CRA007 by Master Builders or approved equal.

F. Epoxy Grout: Epoxy grout shall conform to ASTM C881, Type III, Grade 2, Class C. Color shall be selected by the Engineer.

PART 3 EXECUTION

3.01 CONCRETE MIX

A. Proportions:
1. The work has been designed for concrete having a minimum compressive strength at 28 days as specified in this section.
2. The cement factor and water cement ratio shall be determined by consideration of the specified strength, the water reducing admixtures, the slump required for proper placement, air-entraining requirements, the available and maximum allowable aggregate size and its specific gravity and the amount of water carried on the aggregates.
3. The slumps and maximum sizes of aggregate for various types of construction, as well as the computation of trial mixes shall be as described in ACI 211.1 "Recommended Practice for Selected Proportions for Normal and Heavyweight Concrete".

B. Water Cement Ratio: The water cement ratio shall be as determined from the approved design mixes as specified in this section.

C. Water Content:

1. In calculating the total water content in any mix, the amount of water carried on the aggregate and the effect of admixtures shall be included. The water on the aggregate shall be determined periodically by test and the amount of free water on the aggregate subtracted from the water added to the mix.
2. In all cases the amount of water to be used shall be the minimum amount required to produce a plastic mixture of the strength specified and of the required density, uniformity and workability. The consistency of any mix shall be at that required for the specific placing conditions and methods of placement.

D. Concrete Slumps:

1. The Contractor must satisfy himself that he is capable of producing, with the following slumps, concrete of satisfactory quality and strength, that will produce the specified finishes, free of voids, honey-combing, or excessive air bubbles.
2. Execution of this contract signifies that the Contractor accepts full responsibility for the production of concrete of satisfactory quality, strength and finishes within the slump limitations specified. Slump shall be determined as per ASTM C143.

Types of Construction	Maximum (inches)	Minimum (inches)
Reinforced Footings and Mats	3	1
Substructure Walls	4	1
Slabs, Beams and Reinforced Walls	4	1
Mud Slabs	5	2

E. Air Entrainment:

1. All concrete subject to freezw-thaw cycles shall be air entrained for Exposure Class F2 as defined in ACI 318. Percent of air versus aggregate size shall be added as a part of the computed mixing water requirements, and be used strictly in accordance with the manufacturer's directions and these specifications to produce a total entrained air content, by volume, to be determined in accordance with the procedure given in ASTM C173, as follows:

Nominal Maximum Size Coarse Aggregate (inches)	Air Content By Volume (percent)
3/8	6 to 10
1/2	5.5 to 8.5
3/4	4.5 to 7.5
1	4.5 to 7.5
1-1/2	4 to 7

F. Ready Mixed Concrete: It is intended that all of the concrete required for the work be ready mixed in an off site plant. Small amounts for miscellaneous purposes may be site mixed if approved. All concrete produced in an off site plant shall be mixed and delivered in accordance with the requirements of the "Standard Specifications for Ready Mixed Concrete," ASTM C 94 and these specifications.

G. Mixing: Concrete shall be mixed and transported in accordance with the applicable provisions of the "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete" (ACI 304) of the American Concrete Institute and these Specifications.

END OF SECTION

SECTION 03315

MISCELLANEOUS CONCRETE PLACEMENTS

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes all labor, materials, tools and equipment necessary for the construction of concrete specialties as specified herein, as shown on the Drawings or as necessary for the proper completion of the work.

PART 2 PRODUCTS

2.01 EQUIPMENT FOUNDATIONS

A. All floor-mounted mechanical and electrical equipment shall be installed on concrete pads constructed of 4,000 psi concrete, whether or not specifically indicated on the drawings to be pad mounted.

2.02 GROUTING

A. General: Grouting is required for structural items and mechanical items. The materials to be used for mechanical items and base plates shall be as specified in Section 03345 Concrete Placing, Curing and Finishing.

2.03 CONCRETE FILLS

A. All concrete fills shall be 4,000 psi.

B. Thin Set Fills: Concrete fills two inches thick shall have a maximum size aggregate of 1/2-inch.

C. Thick Set Fills: Concrete fills greater than two inches thick shall be structural concrete as specified in Section 03300, Cast-In-Place Concrete.

2.04 DUCTBANKS (PROVIDED BY ELECTRICAL CONTRACTOR)

A. All underground electrical ductbanks shall be encased in concrete with materials specified herein.

B. Cement, aggregate and all other concrete components shall be as specified herein except that aggregate size shall not exceed 3/8-inch. Concrete shall have a minimum compressive strength at 28 days of 2,500 psi. Concrete placedwithin four feet of grade shall be air entrained as specified in Section 03300, Cast-In-Place Concrete.

C. Ductbanks shall be reinforced when crossing the backfill covering new pipe lines, roads, parking lots or any area subject to vehicular traffic. Beneath these areas, ductbanks shall

be reinforced with a minimum of #5 @ 12" longitudinal and #4 @ 12" ties, extending 4 feet beyond area needing protection.

PART 3 EXECUTION

3.01 EQUIPMENT FOUNDATIONS

A. All equipment foundations shall be sized to suit equipment with reinforcement as shown on the equipment pad detail on the Drawings. Pads shall not be poured until all equipment sizes have been finalized.

B. All exposed surfaces shall be formed with smooth forms, all coarse aggregate spaded back from the forms so that all exposed surfaces shall have a smooth surface without excessive rubbing and shall be free from sandy streaks, coarse aggregate or stone pockets. All exposed surfaces shall have a smooth, even surface, with all exterior angles beveled and vertical surfaces coved to the floor.

C. The Contractor shall build in all anchor bolts, dowels, sleeves, and other built-in fittings as required for the equipment.

3.02 PITS, SUMPS AND TRENCHES

A. Care shall be required of the Contractor in the construction of all indicated pits, sumps and trenches to ensure provisions are made for all built-in or attached frames, embedded items, pipes and sleeves.

B. Waterstops shall be installed in all concrete joints as indicated.

C. Floors shall present a smooth evenly troweled surface, properly sloped to drains.

3.03 GROUTING

A. Surface Preparation:
   1. The concrete surfaces shall be cleaned of all contamination and debris, chipping or roughening the surface if any laitance or poor concrete is in evidence.
   2. Special care shall be taken with the grout in hot or cold weather to ensure proper setting and gain of strength. Aggravating conditions of placement are to be alleviated to an extent that the temperature of the grout up until time of set will be in about the range of 60 to 80 degrees F. Shields from the sun and hot winds shall be provided when required.
   3. Following cleaning, the concrete shall be water-saturated for a period of six hours, the excess water then removed from the surface and non-absorbent edge forms erected.

B. Grouting of Equipment:
   1. Grout shall be placed quickly and continuously, shall completely fill the space to be grouted and be thoroughly compacted and free of air pockets.
   2. The grout may be poured in place, pressure grouted by gravity, or pumped. Whenever practical, grout shall be poured from one side only and made to flow across to the open side to avoid air-entrapment.

3.04 CONCRETE FILLS

A. Surface preparation for concrete fills shall conform to applicable portions of Section 03345 Concrete Placing, Curing and Finishing.

3.05 PADS AND BASES

A. All concrete work for the equipment pads shall be as specified herein and as detailed in the Contract Documents. The Contractor shall be responsible for the excavation, installation of this concrete work, and backfill.

3.06 DUCTBANKS (PROVIDED BY ELECTRICAL CONTRACTOR)

A. Not less than four inches of concrete shall be between the outside of a duct and the earth. Not less than four inches of concrete shall be between adjacent ducts.

B. All duct line concrete pours shall be continuous between manholes or handholes and between manholes or handholes and structures.

C. Ductbanks shall be laid in trenches on mats of screened gravel not less than 6-inches thick and well graded.

D. Where duct lines pass through concrete walls, concrete envelopes shall be extended through and finished flush with inside surfaces. Watertight construction joints of an approved type shall be provided.

END OF SECTION

SECTION 03345

CONCRETE PLACING, CURING AND FINISHING

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes all labor, materials, tools and equipment necessary for the placing, curing and finishing of all cast-in-place concrete as shown on the Drawings, specified herein and evidently required to complete the work.

1.02 SUBMITTALS

A. Shop drawings, brochures and samples shall be submitted for all items to be furnished in accordance with the provisions of Section 01300.

B. Submittals required under this section shall include, but are not limited to the following:
   1. Manufacturer's Literature - including technical and installation information for:
      a. Cement Grout (Non-Shrink)
      b. Membrane Curing Compound
      c. Curing Paper
      d. Concrete Sealer
      e. Floor Hardener
      f. Epoxy Bonding Compound
      g. Rod Stock

1.03 ENVIRONMENTAL CONDITIONS

A. Protection:
   1. Fresh concrete shall be adequately protected from freezing, premature drying, heavy rains, flowing water and mechanical injury. Provisions shall be made for maintaining new concrete in a continuously moist condition for at least seven (7) days after placement.

B. Cold Weather Requirement:
   1. When placing concrete in cold weather, the recommendations of the American Concrete Institute's Publication "Cold Weather Concreting" ACI-306R shall be followed insofar as the Engineer may direct. The use of set accelerators will be at his discretion except that no calcium chloride will be allowed. All concrete shall be maintained continuously moist with temperature above 50 degrees for 7 days after placement.
   2. When it is necessary to heat the materials in order that the concrete when placed will have a temperature within the allowable range, water and aggregates shall be introduced into the mixer and the temperature allowed to stabilize before the cement is added. If heating of aggregates is not practicable, the water may be heated to any temperature required to produce a water-aggregate temperature in the 60 degrees to 80 degrees F. range. Cement should never be added to a mix having a higher temperature due to the danger of producing a flash set. When aggregate heating is required and steam in pipes is not available, steam jets may

be the only practicable method. With this method the amount of free water on the aggregate will vary considerably and the mixing water will have to be adjusted for each batch. In general, there is more danger in overheating water and aggregates, and producing mix temperatures on the high side of the allowable than there is in being on the low side.

3. Regardless of materials heating or the use of admixtures, protective measures shall be taken to maintain the temperature of freshly placed concrete as recommended by the ACI for the particular condition. Data on the duration of recommended protection, safe final removal of shores and forms, and the like appears in the ACI publication "Cold Weather Concreting" (ACI-306R).

4. The methods of protecting freshly placed concrete will be subject to the approval of the Engineer. In general, external heating will not be required during the first three days if measures are taken to retain the heat of hydration. Such measures shall be commercial batt insulation, insulating board, loose fill insulation, or other material approved by the Engineer. Canvas or plastic film shall be used to protect the insulations from precipitation. After three days, if heating is required to maintain the temperature of the concrete above freezing, it shall be provided as required. Exhaust steam is the best method, is fire safe, and does not dry the surface of the concrete. Airplane heaters, located outside the structure or enclosure and blowing hot air into it are acceptable but not preferred. Open fires and salamanders without proper ventilation will not be allowed due to the fire hazard and strong carbon dioxide atmosphere which is detrimental to freshly placed concrete.

C. Hot Weather Requirements:

1. For concrete placed during extremely warm weather, the aggregate shall be cooled by frequent spraying in such manner as to utilize the cooling effect of evaporation. Temperature of the concrete when placed shall not be more than 90 degrees F. If such a temperature cannot reasonably be maintained, the Engineer shall be notified in order to permit redesign of the mix at his direction to compensate for loss of strength resulting from higher mix temperatures. Newly placed concrete shall be protected from the direct rays of the sun and the forms and reinforcement, just prior to placing, shall be sprinkled with cold water.

2. During periods of excessively hot weather (90 degrees F., or above), ingredients in the concrete shall be cooled insofar as possible and cold mixing water shall be used to maintain the temperature of the concrete at permissible levels, all in accordance with the provisions of ACI 305R, "Hot Weather Concreting".

3. Temperature records shall be maintained giving air temperature, general weather conditions (calm, windy, clear, cloudy, etc.) and relative humidity. The record shall include checks on temperature of concrete as delivered and after placing in forms. Data shall be correlated with the progress of the work so that conditions surrounding the construction of any part of the structure can be ascertained. A copy of the weather data shall be included in the permanent records of the job. During excessively hot weather not more than one hour shall elapse between time of adding water to cement or cement to aggregate, and time of placing concrete.

1.04 EVALUATION OF CONCRETE

A. The Contractor shall comply with ACI 318, Chapter 26.

B. Concrete test results and reports by the testing laboratory shall be the basis for evaluating concrete strength.

C. The strength of the structure in place will be considered potentially deficient if it fails to comply with any requirements which control the strength of the structure, including but not necessarily limited to the following conditions:
   1. Low strength concrete as designated by ACI 318, Chapter 26.
   2. Reinforcing steel size, quantity, strength, position or arrangement at variance with the requirements of Section 03200, Concrete Reinforcement and/or the Drawings.
   3. Concrete which differs from the required dimensions or locations in such a manner as to reduce strength.
   4. Curing less than specified.
   5. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
   6. Mechanical injury, construction fires, accidents or premature removal of formwork likely to result in deficient strength.
   7. Poor workmanship likely to result in deficient strength.
   8. Surface defects that exceed what is acceptable to repair or where installed repairs are not sufficient.

D. Where the strength of the structure is considered potentially deficient, core tests in accordance with ASTM C42 and/or load tests evaluated in accordance with ACI 318, Chapter 27 may be ordered by the Engineer. Should the Contractor elect to make core tests of questionable concrete, all expenses incidental thereto shall be paid by the Contractor. Should the Engineer direct that core tests be made, all costs will be paid for by the Owner if such tests prove the concrete to be satisfactory. If unsatisfactory, all costs including additional testing of replaced work shall be paid for by the Contractor.

E. Concrete work judged inadequate by results of core tests and/or load tests shall be removed and replaced if so directed by the Engineer at the Contractor's expense.

F. Water Tightness:
   1. The following concrete basins shall be tested for water tightness:
      a. Intermediate Wetwell.
      b. Clearwell.
      c. Backwash Supply Tank.
      d. Spent Backwash Tank.
   2. Testing Procedure:
      a. On completion of the tank, and prior to any specified backfill placement, the following test shall be applied individually to each basin to determine water tightness.
      b. Fill the tank with potable water to the maximum level and let it stand for at least 24 hours.
      c. Measure the drop in liquid level over the next 72 hours to determine the liquid volume loss for comparison with the allowable leakage. Evaporative losses shall be measured or calculated and deducted from the measured loss to determine net liquid loss (leakage). The net liquid loss for a period of 24 hours shall not exceed 0.1 of 1 percent of the tank capacity.
      d. If the leakage exceeds the maximum allowable, the leakage test shall be extended to a total of five days. If at the end of five days average daily

leakage does not exceed the maximum allowable, the test shall be considered satisfactory. If the net liquid loss exceeds the maximum allowable, leakage shall be considered excessive and the tank shall be repaired, and retested until leakage falls within the appropriate limit.

e. Damp spots on the exterior wall surface, or interior common walls, or measurable leakage of water at the wall base shall not be permitted. Damp spots are defined as spots where moisture can be picked up on a dry hand. The source of water movement through the wall shall be located and permanently sealed in an acceptable manner. Leakage through the wall-base joint shall likewise be corrected.

PART 2 PRODUCTS

2.01 CEMENT GROUT

A. Grout shall be Five Star Grout as made by U.S. Grout Company, or equal.

2.02 ROD STOCK

A. Shall be a closed cell polyethylene foam furnished in sizes one third greater in diameter than the joint.

2.03 JOINT SEALANT

A. Joint sealant shall be furnished and installed by the Waterproofing, Dampproofing, and Caulking Filed Sub-Bid in accordance with Specification Section 07900, Joint Sealants.

2.04 CONCRETE SEALER

A. All interior concrete floors to be exposed upon completion of this work, and for which no other surface treatment is specified, shall have an application of Euco Diamond Hard as produced by Euclid Chemical Company., or equal. The material shall be applied and cured in accordance with manufacturer's directions at the rate of 200 to 250 sq. ft. per gallon.

2.05 MEMBRANE CURING COMPOUND

A. May be used only on walls and slabs not subject to further treatment such as painting, concrete sealer,or other bonded topping or coatings. If used, it shall be Tammscure WB as manufactured by Euclid Chemical Company or equal product conforming to ASTM C309, Type 1 or 1D, Class B. Compound shall be applied uniformly by spray, leaving no pinholes or gaps, at a coverage rate not to exceed 400 square feet per gallon. The curing compound shall be applied after finishing operations are completed and surface moisture has disappeared. Any compound used must be of a type which will not contaminate potable water.

B. If forms are removed prior to eight days after placing the concrete, the uncovered surfaces shall be coated with the curing compound as specified herein.

2.06 CURING PAPER

A. Shall be used to cure floors which are to have applied toppings or chemical hardeners. Curing paper shall also be used in other areas to protect newly poured concrete floors from damage. Material shall conform to ASTM C171, for regular or white waterproof paper.

2.07 EPOXY BONDING COMPOUNDS

A. Shall be Sikadur 32 Hi-Mod as made by Sika Corporation, or equal.

2.08 BOND BREAKER

A. Shall be 15 pound asphalt saturated roofing felt.

PART 3 EXECUTION

3.01 CONCRETE PLACING

A. Placing:
1. Concrete shall be placed in accordance with the applicable provisions of the "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete" (ACI 304) of the American Concrete Institute and these specifications.
2. Concrete shall be handled from the mixer, or truck if ready-mixed concrete is used, to the place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients but in no case shall the time elapsed between the addition of the water to the cement or the cement to the aggregates and the placing of concrete in the forms exceed one and one-half (1-1/2) hours. In periods of excessive hot weather as previously defined in paragraph 1.03.C. of this section, this time shall be reduced to one hour.
3. The concrete shall be deposited in the forms as nearly as practicable in the final position to avoid rehandling and shall be so deposited as to maintain a homogeneous plastic surface approximately horizontal. Water shall be removed from all forms, trenches, and excavations and the work shall be kept dry while the concrete is being placed. No water shall be thrown on or allowed to flow over or rise upon the concrete until it has had time to become thoroughly set.
4. The maximum free fall of any concrete shall be limited to six feet. Accumulation of concrete on the forms or reinforcement above level of the placement shall be avoided. Concrete that is partially hardened, or has been contaminated by foreign material or that has been retempered will not be permitted on this project. A concrete placement, once started, shall be carried on as a continuous operation until the placing of the section is completed.

B. Runways:
1. Runways shall be provided for wheeled concrete handling equipment. Such equipment shall not be wheeled over reinforcement nor shall runways be supported on reinforcement.

C. Chuting:
1. When concrete is conveyed in chutes, the equipment shall be of such size and design as to insure a continuous flow in the chute. The chute shall be of steel or

be steel lined, and the different sections shall have the same slope throughout. Aluminum chutes will not be allowed. The slope shall be not flatter than 3 horizontal to 1 vertical or steeper than 2 horizontal to 1 vertical and, between these limits, the slope shall be that which will prevent segregation of ingredients. The end of the chute shall be provided with a baffle to prevent segregation of ingredients. If the end of the chute is more than three feet above the surface of the concrete in the forms, a spout shall be used. The spout shall be kept full of concrete and the lower end maintained as near to the surface of deposit as practical. The chute shall be thoroughly flushed with water before and after each run. The water used shall be discharged outside the forms.

D. Bonding:

1. After a section has been completed, any laitance on the temporary top surface of construction joints shall be removed and the surface raked immediately after the initial set has taken place. If removal of the laitance is delayed until the concrete has set, so that laitance cannot be removed by shovels or scrapers, the Contractor shall remove it by power chipping tools.
2. Before depositing concrete on or against concrete which has set, the surface of the set concrete shall be roughened, thoroughly cleaned with wire brushes, air blasted, and then saturated with water. The new concrete placed in contact with hardened or partially hardened concrete shall contain an excess of cement to secure bond. The surface of the hardened concrete shall be slushed with a coating of neat cement grout against which the new concrete shall be placed before the grout has attained its initial set. Where noted or where an unplanned interruption in a concrete placement has occurred, bonding shall be with epoxy bonding compound used in accordance with the material manufacturer's recommendations.

E. Compaction:

1. Concrete shall be placed in layers not exceeding 12 inches in depth, and each layer shall be compacted by mechanical internal-vibrating equipment supplemented by hand spading, rodding, and tamping as required.
2. Form vibrators will be considered only where internal vibration is impractical and will be allowed only with the written permission of the Engineer. When allowed, the vibrator shall be placed so that motion is horizontal and vibration in any location shall not be continued to the extent that segregation occurs, but vibrators shall be relocated frequently. Vibrators shall not be used to transport concrete within the forms. Concrete shall be thoroughly worked around reinforcement, embedded fixtures and into the corners of the forms.
3. Compaction shall be in accordance with ACI 390, "Recommended Practice for Consolidation of Concrete" as modified by this specification.

F. Construction Joints:

1. Joints not indicated on the drawings shall be made and located so as to least impair the strength of the structure. Where a joint is to be made, the surface of the concrete shall be roughened, thoroughly wetted, and slushed with a coat of neat cement grout immediately before placing new concrete. Where the joint occurs in a portion of the structure which must be watertight, waterstops as specified in Section 03250, Concrete Accessories shall be used.
2. Reinforcement shall be continuous through all construction joints, unless otherwise noted on the drawings. Continuous keyways and waterstops shall be provided where called for on the drawings or as specified. Waterstops shall be as

previously specified and shall be installed in accordance with the following: The Contractor shall take all necessary precautions to positively insure that the waterstop is properly located and aligned and remains so after the concrete placement has started and the waterstop is partially covered even to the extent of omitting form boards temporarily, if necessary. The Contractor shall likewise insure that the vibrators are always kept several inches clear of the waterstop. In the event that the waterstop is improperly located, allowing a tolerance of plus or minus 1/2 inch, the Engineer may order the waterstop extended, or replaced, or such other action as they may deem necessary and all expenses incidental thereto shall be paid by the Contractor and he shall not be entitled to reimbursement therefor.

G. Contraction Joints:
1. Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC insert strips into the plastic concrete or by cutting the concrete with a saw after concrete has set.
2. Joints shall be approximately 1/8 inch wide and shall extend into the slab approximately 1/4 the slab thickness, but not less than 1 inch.

H. Sawed Joints:
1. Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling.
2. Concrete-sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed. Use Soft-Cut saw blades for early cutting.

I. Joint Sealant:
1. Joint sealant shall be installed by the Waterproofing, Dampproofing, and Caulking Filed Sub-Bid in accordance with Specification Section 07900, Joint Sealants.
2. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant. Joints sealed with field molded sealant shall be completely filled with sealant.

3.02 CURING AND PROTECTION

A. Curing:
1. Shall be accomplished by the use of waterproof paper, curing compounds, "wet" methods (fog spray, damp sand or burlap) or other methods dependent upon the end used of the concrete. Provisions shall be made for maintaining new concrete in a continuously moist condition for a minimum of seven days.
2. The use of curing compound on surfaces to receive coating or bonded finished will not be allowed.

B. Concrete Slab Protection:
1. Finished concrete slabs shall be covered with curing paper as specified, laid with side joints lapped four inches and end joints lapped six inches. Paper shall be applied no sooner than 24 hours and not over 30 hours after finishing the slab and shall be left in place at least ten days. Joints shall be taped and paper shall be

weighted to prevent displacement. Rips or tears appearing in the paper during the first seven days after a floor is completed shall be immediately patched. No traffic will be permitted until five days after pouring. From 5 to 15 days only light traffic will be permitted.

2. Where the use of wrenches and other heavy tools may be required, the Contractor shall provide additional protection as required.

3.03 DEFECTIVE CONCRETE

A. Concrete work not formed as shown on the drawings, out of alignment or level, or showing a defective surface, shall be removed and completely replaced if directed by the Engineer.

B. Slight imperfections in appearance of the structure may be patched as specified herein provided the permission of the Engineer is obtained prior to patching.

3.04 REPAIR OF SURFACE DEFECTS

A. General:

1. Immediately after the forms are removed, all form ties shall be cut off below surface of concrete, all fins and irregularities shall be removed and all defective areas, holes, honeycombs, cavities and irregularities cleaned and patched with a stiff mortar of the same composition as the mortar in the original concrete mix, all as specified herein. Exposed patchwork shall be rubbed where and as specified herein or otherwise treated to match adjacent surfaces.

B. Patching:

1. Defective areas for which patching is allowed shall be cleaned of all dust, dirt, grease, laitance, and loose or spalling concrete, and be given a brush applied coat of an epoxy bonding compound approved by the Engineer.

2. The compound shall be mixed as directed by the manufacturer. The patching mortar shall be freshly mixed and be composed of the same materials and proportions as were used for the original concrete, including the admixture, except that the coarse aggregate shall be omitted and fine aggregate substituted therefor. The placing of mortar shall begin immediately after the bonding compound is applied and shall be completed within the contact time. The bonding compound shall be sticky to the touch during placing of mortar. The patching shall be finished to match adjoining concrete, and cured and protected as specified for concrete. The manufacturer's directions and precautions shall be followed when using such compounds.

C. Filling Form Tie Holes:

1. Holes left by withdrawal of rods or by removal of end ties shall be filled solid with mortar, using epoxy bonding compound in the same manner as specified under "Patching" above. Holes passing entirely through the wall shall be filled using small tools that will pack the hole solidly with mortar. Excess mortar at the surface of the wall shall be struck off flush with a cloth.

D. Rubbed Finish:

1. Surfaces requiring remedial work which are to be exposed to view whether painted or not, including, but not limited to, all internal tank and clearwell surfaces and building surfaces, shall have all projections and irregularities carefully removed

and all cavities filled with stiff mortar of the same composition as the mortar in the concrete. The same brand and color of cement, and the same kind and color of aggregate shall be used for filling cavities as was used in the original concrete mix. The surface film of all such pointed surfaces shall be carefully removed before setting occurs. The preceding operations shall be done within 24 hours after removal of the forms. If, after patching and smoothing, surfaces do not present a smooth surface of even texture and appearance, then the following finish shall be repeated as many times as the Engineer deems necessary. The Engineer shall be the sole judge of the amount of rubbing required.

2. Immediately after the forms are removed, and necessary patching and smoothing is done, the surface shall be wetted with clean water, without applying any cement or other coating, and rubbed with a No. 16 carborundum brick or other abrasive of equal quality until even and smooth and of uniform appearance.
3. The final finish shall be obtained by a thorough rubbing with a No. 30 carborundum brick or other abrasive of equal quality.
4. After final rubbing is completed, the surface shall be thoroughly drenched and kept wet for a period of five days, unless otherwise directed. No rubbing will be permitted in cold or freezing weather, except in heated enclosures.

3.05 FINISH OF FORMED SURFACES

A. General: Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
   1. Rough-Formed Finish (RfFm-Fn): For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing materials used, with tie holes and defective areas repaired and patched and fins and other projections exceeding specified limits rubbed down or chipped off.
   2. Smooth-Formed Finish (SmFm-Fn): For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections exceeding specified limits removed and smoothed.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
   2. Class C, 1/2 inch (13 mm) for rough-formed finished surfaces.

D. Grout Rubdown:
   1. While the concrete is still damp, a thin coat of medium consistency neat cement slurry shall be applied to the concrete surface by means of bristle brushes to provide a bonding coat in the parent concrete. Before the slurry has dried or changed color, a dry (almost crumbly) grout comprising one volume cement, the same as used for the parent concrete, adjusted with white cement to match color where exposed, to 1-1/2 volumes of sand, shall be applied. This grout shall be applied by means of slightly damp pads of coarse burlap approximately 6 inch

square used as a float. The grout shall be well scrubbed into the surface to provide a dense mortar.

2. The mortar shall be allowed partially to harden from one to two hours depending upon the weather. Work in direct hot sunlight shall be avoided, and if the air is hot and dry, the concrete shall be kept damp during this period with a fine fog spray.
3. When the grout has hardened sufficiently, all the grout that can be removed shall be removed with a trowel. Grout shall not be allowed to remain on the concrete too long since it will become difficult to remove.
4. The surface shall then be allowed to dry thoroughly and then be rubbed vigorously with clean, dry burlap to completely remove any dried grout. There should be no visible film of grout remaining after this rubbing.
5. The entire operation shall be completed in one working day. No grout shall be left on the concrete overnight. Sufficient time shall be allowed for the grout to dry after it has been cut with a trowel so that it can be wiped off clean with burlap.
6. On the day following, the concrete shall again be wiped clean with dry burlap to remove any inadvertent dust. At this time, the use of a piece of burlap containing old hardened mortar may be helpful since it will act as a mild abrasive. After this treatment no build-up film should remain on the parent surface. If however, such is present, a fine abrasive stone shall be used to remove all such material without breaking through the surface film of the parent concrete. Do not work up a lather.
7. After application of the surface grout, the surface shall be thoroughly washed down with stiff brushes and the concrete maintained in a continuously damp condition for at least three days above 50 degrees F. by the periodic application of a fine fog spray or by the use of a poultice of damp flannel covered with polyethylene taped to the concrete.

3.06 FINISHING OF RELATED UNFORMED SURFACES

A. Tops of exposed beams, walls, parapets and tops of similar unformed surfaces occurring adjacent to formed surfaces shall be struck off smooth and be hand steel troweled by cement masons assisted by a field party to continually verify and check correct lines and elevations, so as to produce a smooth hard level surface. Line and elevation shall be pre-established by means of preset wood screeds which shall be removed during the troweling operation.

B. After above troweling operations have been completed and after concrete has cured, the above troweled surface shall be dry honed to a smooth non-directional surface texture satisfactory to the Engineer.

3.07 FINISH OF FLOOR SLABS

A. General:

1. Concrete slabs shall be finished as hereinafter described. The dusting of wearing surfaces with dry materials will not be permitted. In preparation for finishing, floor slabs shall be struck off true to the required grade and level shown on the drawings. Finish interior floor slab surfaces to the following tolerances , according to ASTM E1155 for a randomly trafficked floor surface:
   a. Unsloped Floors: Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

b. Sloped Floors: Slope uniformly to elevations specified. Slope lines shall be uniform to a tolerance of plus or minus ¼" vertical within any 10 foot horizontal measurement, sloped to drains where indicated.

B. Floated Finish:

1. Concrete slabs to receive seamless floor finish, built-up roofing, wood sleeper as specified, or as indicated on the drawings shall receive a floated finish. After the concrete has been placed, struck off, consolidated and leveled, the concrete shall not be worked further until ready for floating.
2. Floating shall begin when the water sheen has disappeared, and/or when the mix has stiffened sufficiently to permit the proper operation of a power-driven float. The surface shall then be consolidated with power-driven floats. Hand floating with wood, aluminum or magnesium floats shall be used in locations inaccessible to the power-driven machine.
3. Trueness of surface shall be rechecked at this stage with a ten foot straightedge applied at no fewer than two different angles. All high spots shall be cut down and all low spots filled during this procedure such that the finished surfaces are true planes. The slab shall then be refloated immediately to a uniform, smooth, granular texture.

C. Troweled Finish:

1. Concrete slabs to receive carpeting, resilient and ceramic tiles, all interior slabs left exposed or as specified herein and as indicated on the drawings shall receive a trowel finish. After the concrete has been placed, struck off, consolidated, screeded and darbied, and as soon as the condition of the slab permits, and before it has hardened appreciably, all water, film and foreign material which may work to the surface, shall be removed by means of lutes, or bull floats.
2. The surface shall be finished first with power floats, as specified above, then with power trowels, and finally with hand trowels. The first troweling after power floating shall be done by a power trowel and shall produce a smooth surface which is relatively free of defects but which may still contain some trowel marks. Additional trowelings shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be free of any trowel marks and uniform in texture and appearance.

D. Broom Finish:

1. Sidewalks, platforms, ramps, exterior stairs or as specified herein or shown on the drawings shall receive a broom finish. After floating, and between the time of initial and final set, the surface shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

E. Scratched Finish:

1. Concrete slabs to receive cement waterproofing, concrete, grout fill or finish material to be bonded to cement mortar or as indicated on the drawings or specified shall receive a scratched finish. After concrete has been placed, struck off, consolidated and level to a true plane, the surface shall be roughened with stiff brushes or raked before final set.
2. For metallic waterproofing, finish shall be in accordance with the manufacturer's requirements.

3.08 CLEANING CONCRETE

A. Cleaning Concrete:
   1. The Engineer may require remedial action by the Contractor to remove blemishes, rust, stains, or discolorations from the exposed concrete. General cleaning shall be done with a non-etching cleaning agent used as per manufacturer's instructions. The cleaner shall be used on all surfaces to receive a painted finish.

B. In the event of a severe blemish or discoloration which cannot be removed with a non-etching agent, the Contractor shall notify the Engineer immediately and consider the following:
   1. A clean down with mild solution of detergent and water applied by scrubbing vigorously with soft bristle brushes, then flushing with water. Rust stains may be removed by applying a bleaching agent such as oxalic acid.
   2. Cleaning operation shall not begin until superstructure is entirely completed and then only where and as directed by the Engineer. Cleaning portions of building as work progresses is not permitted.
   3. Cleaning by other methods, bleaching, acid etching, sandblasting or any other procedure suggested by the Contractor and proven to be effective.

END OF SECTION

SECTION 03600

GROUT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install grout complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Documents affecting work of this Section include, but are not necessarily limited to, General and Supplementary Conditions and Sections in Division 1 of these Specifications.
   1. Section 03100 Concrete Formwork
   2. Section 03200 Concrete Reinforcement
   3. Section 03250 Concrete Accessories
   4. Section 03300 Cast-in-Place Concrete
   5. Section 04200 Unit Masonry

1.03 SUBMITTALS

A. Shop drawings and product data in accordance with Section 01300 showing materials of construction and details of mixing and installation for:
   1. Commercially manufactured nonshrink cementitious grout and underlayment grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations and conformity to the specified standards.
   2. Cement grout: The submittal shall include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures and the proposed mix of the grout.

B. Samples:
   1. Submit samples of commercially manufactured grout products when requested by the Engineer.
   2. Submit aggregates proposed for use in mixes when requested by the Engineer.

C. Laboratory Test Reports:
   1. Submit laboratory test data as required under Section 03300 for concrete to be used as concrete grout.

D. Qualifications:
   1. Grout manufacturers shall submit documentation that they have at least ten years experience in the production and use of the grouts which they propose to supply.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):
   1. ASTM C33 – Standard Specifications for Concrete Aggregates,
   2. ASTM C150 – Standard Specifications for Portland Cement,
   3. ASTM C827 – Standard Test Methods for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures,
   4. ASTM C1107 – Standard Specifications for Packaged Dry, Hydraulic – Cement Grout (Nonshrink).

B. U.S. Army Corps of Engineers Standard (CRD):
   1. CRD-C 621 – Corps of Engineers Specification for Nonshrink Grout.

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Grout manufactures shall have a minimum of ten years experience in the production and use of grout proposed for the work.

B. Pre-installation Conference:
   1. Well in advance of grouting, hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing, and curing procedures for each product proposed for use. Parties concerned with grouting, including the Engineer, shall be notified of the meeting at least ten days prior to its scheduled date.

C. Services of Manufacturer's Representative:
   1. A qualified field technician of the nonshrink grout manufacturer, specifically trained in the installation of the products, shall attend the pre-installation conference and shall be present for the initial installation of each type of nonshrink grout and underlayment grout. Additional services shall also be provided, as required, to correct installation problems.

D. Field Testing:
   1. All field testing and inspection services required shall be provided by the Owner. The Contractor shall assist in the sampling of materials and shall provide any ladders, platforms, etc. for access to the work. The methods of testing shall comply in detail with the applicable ASTM Standards.
   2. The field testing of concrete grout shall be as specified for concrete in Section 03300.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers and printed instructions.

B. Store materials in full compliance with the manufacturer's recommendations. Total storage time from date of manufacture to date of installation shall be limited to six months or the manufacturer's recommended storage time, whichever is less.

C. Material which becomes damp or otherwise unacceptable shall be immediately removed from the site and replaced with acceptable material at no additional expense to the Owner.

1.07 DEFINITIONS

A. Nonshrink Grout: A commercially manufactured product that does not shrink in either the plastic or hardened state, is dimensionally stable in the hardened state and bonds to a clean base plate.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and product or catalog number is for the purpose of establishing the standard of quality desired.

B. Like materials shall be the products of one manufacturer or supplier in order to provide standardization of appearance.

2.02 MATERIALS

A. Nonshrink Cementitious Grout:
1. Nonshrink cementitious grouts shall meet or exceed the requirements of ASTM C1107 Grades B or C and CRD-C 621. Grouts shall be portland cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents and shall require only the addition of water. Nonshrink cementitious grouts shall not contain expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827.
a. General purpose nonshrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Euco NS by The Euclid Chemical Co.; NBEC Grout by Five Star Products, Inc. or equal.
b. Flowable (Precision) nonshrink cementitious grout shall conform to the standards stated above and shall be Hi-Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Five Star Grout by Five Star Products, Inc. or equal.

B. Cement Grout:
1. Cement grout shall be a mixture of one part portland cement conforming to ASTM C150 types I, II, or III and one to two parts sand conforming to ASTM C33 with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout but not to the degree that it will allow the grout to flow.

C. Water:

1. Potable water, free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

PART 3 EXECUTION

3.01 PREPARATION

A. Grout shall be placed over cured concrete which has attained its full design strength unless otherwise approved by the Engineer.

B. Concrete surfaces to receive grout shall be clean and sound; free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints and free of all loose material or foreign matter which may effect the bond or performance of the grout.

C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.

1. Air compressors used to clean surfaces in contact with grout shall be the oilless type or equipped with an oil trap in the air line to prevent oil from being blown onto the surface.

D. Remove all loose rust, oil or other deleterious substances which may affect the bond or performance of the grout from metal embedments or bottom of baseplates prior to the installation of the grout.

E. Concrete surfaces shall be washed clean and then kept moist for at least 24 hours prior to the placement of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, flooding the surface, or other method acceptable to the Engineer. Upon completion of the 24 hour period, visible water shall be removed from the surface prior to grouting.

F. Construct grout forms or other leakproof containment as required. Forms shall be lined or coated with release agents recommended by the grout manufacturer. Forms shall be of adequate strength, securely anchored in place and shored to resist the forces imposed by the grout and its placement.

G. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.

H. Equipment shall be supported during alignment and installation of grout by shims, wedges, blocks, or other approved means. The shims, wedges, and blocking devices shall be prevented from bonding to the grout by appropriate bond breaking coatings and removed after grouting unless otherwise approved by the Engineer. Grout voids created by the removal of shims, wedges and block.

3.02 INSTALLATION – GENERAL

A. Mix, apply and cure products in strict compliance with the manufacturer's recommendations and these specifications.

B. Have sufficient manpower and equipment available for rapid and continuous mixing and placing. Keep all necessary tools and materials ready and close at hand.

C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40 degrees F and 90 degrees F during grouting and for at least 24 hours thereafter or as recommended by the grout manufacturer, whichever is longer. Take precautions to minimize differential heating or cooling of baseplates and grout during the curing period.

D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the temperature of the materials in contact with the grout are outside of the 60 degrees F and 90 degrees F range.

E. Install grout in a manner which will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or control joint.

F. Inspect all existing underlying control and construction joints through the grout.

3.03 INSTALLATION – CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS

A. Mix in accordance with manufacturer's recommendations. Do not add cement, sand, pea gravel or admixtures without prior approval by the Engineer.

B. Do not mix by hand. Mix in a mortar mixer (with moving blades). Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.

C. Placements greater than 3-in in depth shall include the addition of clean, washed pea gravel to the grout mix when approved by the manufacturer. Comply with the manufacturer's recommendations for the size and amount of aggregate to be added.

D. Provide forms where and as required. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement shall proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.

F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45 degree angle from the lower edge of bearing plate unless otherwise ordered and approved by the Engineer. Finish this surface with a wood float or brush finish.

G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

3.04 SCHEDULE

A. The following list indicates where the particular types of grout are to be used:
   1. General purpose nonshrink cementitious grout: Use at all locations where non-shrink grout is called for on the Drawings except for base plates greater in area than 3-ft wide by 3-ft long.
   2. Flowable nonshrink cementitious grout: Use under all base plates greater in area than 3-ft by 3-ft. Use at all locations indicated to receive flowable nonshrink grout on the Drawings. The Contractor, at his/her option and convenience, may also substitute the flowable, nonshrink, cementitious grout for general purpose nonshrink cementitious grout.
   3. Cement Grout: Use where indicated on the Drawings.

END OF SECTION

INDEX

DIVISION 4 MASONRY

SECTION 04101

MASONRY FILED SUB-BIDS

PART 1 GENERAL

1.01 MASONRY FILED SUB-BID

A. The work of the following sections requires a filed sub-bid in accordance with M.G.L. C.149, S.44A through 44H, inclusive, as amended. These sections will be covered under a single filed sub-bid for the Masonry category of work.
1. Section 04200 – Unit Masonry

B. Reference Drawings: The work of this Section is shown on the following Drawings:
1. 01-A-1 through 01-A-3, 20-A-1 through 20-A-18, 99-A-1 through 99-A-3
2. 01-S-01, 20-S-1 through 20-S-30

C. Requirements of Submitting Sub-bids:
1. Sub-bids for work under this Section shall comply with the requirements of M.G.L. C.149, S.44D and 44F; shall be filed in a form furnished by the Awarding Authority, in a sealed envelope, at the time and place stipulated in the Advertisement for Bids and Information for Bidders; and shall be accompanied by a Bid Deposit in the amount of five percent of the sub-bid price complying with the requirements of M.G.L. C.149, S.44B(2). The following should appear on the upper left-hand corner of the envelope:

SUB-BIDDER: Contractor Name

SUB-BID FOR: Masonry

PROJECT: Wading River Water Treatment Plant
Contract No. 10, DWSRF No. 16764

D. SUB-SUBLISTINGS

1. Sub-sub trades are categories of work within a filed sub-bid trade and are indicated in Paragraph E on the Form for Sub-bid. If sub-sub trades are requested and identified follow the instructions below. The proposed contract price submitted by the filed sub-bidder on the Form for Sub-Bid includes the cost of any sub-sub trades.

a. Sub-sub bids are required for the following subcategories of this section:

Class of Work	Reference Paragraph

2. Sub-bidders shall include the appropriate information for the above listed sub-categories in Paragraph E of the Form for Sub-bid.

3. If the filed sub-bidder customarily performs the above work with its own workforce the sub-bidder should list its own name and trade, and leave the dollar amount blank.

4. If the filed sub-bidder does not customarily perform the above work with its own workforce the sub-bidder should list the name of the contractor performing the work, the trade and insert a dollar amount.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 04200

UNIT MASONRY

(PART OF WORK OF SECTION 04101– MASONRY FILED SUB-BIDS, Filed Sub-Bid Required)

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The work of this Section includes all labor, materials, tools, scaffolding, and equipment necessary to complete the masonry work as required by the Contract Documents. Such work includes, but is not limited to, the following:
   1. Concrete masonry units.
   2. Embedded flashing
   3. Cavity wall insulation.
   4. Mortar and grout.
   5. Reinforcing steel, masonry joint reinforcement, ties and anchors.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
   1. Section 05500 - Metal Fabrications for steel lintels supporting masonry veneer.
   2. Section 06100 - Rough Carpentry for gypsum sheathing on cold-formed metal framing.
   3. Section 07270 - Air and Water Barriers for membrane and liquid applied air barrier.
   4. Section 07920 - Joint Sealants for sealing control and expansion joints in unit masonry.

1.02 SUBMITTALS

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

B. Shop Drawings and submittals shall be provided with 30 calendar days after the Contractor has received the Owner's Notice to Proceed for the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
   3. Samples for Verification: For each type and color of the following:
      a. Exposed concrete masonry units.
      b. Pigmented mortar. Make Samples using the same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
      c. Weep holes/vents.
      d. Accessories embedded in masonry.
   4. Qualification Data: For testing agency.

C. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
   1. Masonry units:
      a. Include material test reports substantiating compliance with requirements.

b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials: Include brand, type, and name of manufacturer.
3. Mortar mixes: Include description of type and proportions of ingredients.
4. Grout mixes: Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

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

1. Include test reports, per ASTM C780 for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91 for air content.
2. Include test reports, per ASTM C1019 for grout mixes required to comply with compressive strength requirement.

E. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.03 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C1093 for testing indicated, as documented according to ASTM E548.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Preconstruction Testing Service: The Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by the Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

1. Prism Test: For each type of construction required, per ASTM C1314.

E. Masonry Standard: Comply with TMS 602-16 unless modified by requirements in the Contract Documents.

F. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Sample panel shall be constructed in the presence of the Engineer and shall be approximately 8-feet long by 4-feet high, including an exterior corner and shall be full cavity wythe showing proposed color range and texture of block veneer, bond, mortar color and joint, ties, insulation, prefaced backup block, and workmanship. Comply with requirements in Division 01 for mockups.

1. Build sample panels for typical exterior and interior walls as indicated on drawings.
2. Clean one-half of exposed faces of panels with masonry cleaner indicated.
3. Protect approved sample panels from the elements with weather-resistant membrane.

4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
    a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Owner or Engineer in writing.

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01. The agenda shall include protection of air barrier membrane during construction.
1. At least 7 days prior to starting masonry work, conduct a meeting to review detailed requirements for mortar and grout mixes and to determine procedures for satisfactory construction and curing operations. Review requirements of submittals, status of coordinating work, and availability of materials. Review requirements for tenting and heating. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with masonry construction to attend, including the following:
    a. General Contractor's Project Manager
    b. Masonry Sub-Contractor's Foreman
    c. Special Inspector
    d. Engineer

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry. Masonry units shall be handled with care to avoid chipping and breakage. Damaged units shall not be used in the exposed work.

B. Masonry units shall be shipped with each pallet wrapped in 10 mil minimum polyethylene plastic film.
1. The wrapping shall not be removed until the concrete masonry units are about to be placed in the wall so as to prevent moisture pickup.
2. Any concrete masonry units left exposed overnight, in the rain or otherwise allowed to pick up moisture shall be rejected.

C. Deliver cementitious materials to the site in unbroken bags, barrels, or other approved containers, plainly marked and labeled with manufacturer's names and brands. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.

E. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

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

1.05 PROJECT CONDITIONS

A. Protection of Air Barrier Membrane: During construction, protect air barrier membrane from penetrations which allow air to pass through air barrier assemblies. Engage original installer to repair damage promptly using identical materials and methods of installation, and to the satisfaction of the Engineer.

B. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
   2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

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

D. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect the base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

E. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

F. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.01 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.02 CONCRETE MASONRY UNITS (CMUs)

A. Concrete Masonry Units: ASTM C90, normal weight unless indicated otherwise manufactured to dimensions 3/8-inch less than nominal dimensions. Unit compressive strength 1,900 psi on the net area, with density classification Normal Weight.

B. Shapes: Provide standard shapes indicated and as required for building configuration. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

C. Decorative Concrete Masonry Units (Veneer block application): ASTM C90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1,900 psi.
   2. Weight Classification: Normal weight.
   3. Size: 4" x 8" x 16" typical, and as required. Manufactured to dimensions specified in "Concrete Masonry Units" Paragraph above.
   4. Pattern and Texture (See Contract Documents for clarity):
      a. Veneer Block Type 1 - Smooth-face CMU finish (color to be selected from manufacturer's full range by Owner).
      b. Veneer Block Type 2 – Ground-face CMU finish (color to be selected from manufacturer's full range by Owner).
   5. Colors: As selected by Owner from manufacturer's full range.
   6. Special Aggregate: Provide units made with aggregate matching aggregate in Owner's/Engineer's sample.
   7. 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:
      a. Trenwyth Industries
      b. Westbrook Concrete Block
      c. Jandris Block

D. Integral Water Repellent: Provide units made with integral water repellent for exterior exposed units.
   1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.
   2. Available products include:
      a. GCP Applied Technologies; Dry-Block.
      b. BASF Construction Chemicals; Rheopel.
      c. Or equal.

2.03 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of Portland cement complying with ASTM C150, Type I or Type III, and hydrated lime complying with ASTM C207, Type S. Acceptable products include the following:
   1. Blue Circle Cement, Inc.: Eaglebond High Strength Type "S".
   2. Cement Quebec, Inc.: Portland and Lime / Type S.
   3. Dragon Cement and Concrete: Type S Masonry Cement.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar. Available products include:
   1. Davis Colors; True Tone Mortar Colors.
   2. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.
   3. Or approved equal.

E. Aggregate for Mortar: ASTM C144. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

F. Aggregate for Grout: ASTM C404.

G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer. Available products include:
   1. GCP Applied Technologies; Dry-Block.
   2. BASF Construction Chemicals; Rheopel.
   3. Or equal.

2.04 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A951.
   1. Interior Walls: Hot-Dip galvanized, carbon steel.
   2. Exterior Walls: Type 316 stainless steel.
   3. Wire Size for Side Rods: 0.188-inch diameter.
   4. Wire Size and Spacing for Cross Rods: 0.148-inch diameter at 16 inches on center.
   5. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Multiwythe Masonry:
   1. Horizontal CMU Joint Reinforcement: Ladder type with pintle and eye for wire ties at 16 inches on center. Provide Hohmann & Bernard 270-2X or equal, Type 316 Stainless Steel.

2.05 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.
   1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82; with ASTM A153/A153M, Class B-2 coating.
   2. Stainless-Steel Wire: ASTM A580/A580M, Type 316.
   3. Galvanized Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 zinc coating.
   4. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

5. Stainless Steel Bars: ASTM A276 or ASTM A666, Type 304.

B. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel.

C. Partition Top Anchors: Hohmann & Barnard PTA 420 HS or approved equal, standard galvanized or stainless steel finish. Coordinate spacing with vertical reinforcing. Insure free and independent movement of structure above CMU partition. Anchor to deck or structural steel above.
   1. Neoprene Sponge for Wall Tops: 3/8" thick. Adhesive backed as required.

D. Adjustable Masonry-Veneer Anchors:
   1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, with structural performance capable of withstanding a 200 lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
   2. Provide Hohmann & Barnard Thermal 2-SEAL Concrete Seal Tie, Type 316 stainless steel, or approved equal.
   3. Accessory: Provide Rigid Insulation Retention.

2.06 MISCELLANEOUS ANCHORS

A. Anchor Bolts: L-shaped steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A153/A153M, Class C; of dimensions indicated.

2.07 EMBEDDED FLASHING MATERIALS

A. Base Wall Flashing: Type 304 or 316 Stainless Steel, 0.019 inch (0.48 mm) thick. Provide flexible flashing drainage plane as detailed. Terminate top edge of flexible flashing drainage plane with compatible termination bar and sealant.

B. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated on the Contract Documents. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch-high end dams. Fabricate through-wall flashing from zinc-coated copper, 20 oz/sq. ft. (0.68 mm thick), with 304/316 stainless steel fasteners.

C. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

D. Solder for Zinc-Tin Alloy-Coated Copper: ASTM B32, 100-percent tin, with maximum lead content of 0.2 percent, as recommended by sheet metal manufacturer.

E. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates. Verify compatibility between flashing materials and substrates.

2.08 INSULATION FOR CAVITY WALLS

A. Insulation for cavity walls shall be rigid fiberglass, Cavitymate Ultra, as manufactured by Dupont, or an approved equal.
   1. Rigid closed cell extruded polystyrene.
   2. R-Value per inch at 75 degrees F shall be 5.6.
   3. Comply with ASTM C518.
   4. Thickness: As noted on the Contract Drawings.
   5. Water absorption (% by volume, max.): 0.1.
   6. Compressive strength: 25 psi.
   7. Width shall be 16 inches.
   8. Flame spread of less than 25 and smoke developed index less than 450.
   9. Adhesive shall be as recommended by the insulation manufacturer.

2.09 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Control-Joint except at Fire Rated Walls: Hohmann and Bernard RS Series size and shape as required.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Provide 3/8" thick x 3-1/2" high x 3-3/8" deep weep vent. To be installed at bottom and top of exterior wall masonry veneer to encourage drying. Color to be selected by the Owner.

E. Rebar Positioners: Hohmann and Bernard RB or equal, hot-dip galvanized at exterior and interior walls and partitions.

F. Grout Stop: Hohmann and Barnard Mortar/Grout Screen or equal.

G. Rigid Anchors: Steel plate 1-1/2” wide by 1/4” thick, 24 inches long, with 2 inch bends at each end. Provide Hohmann and Barnard 344 Rigid Partition Anchor or equal. Provide hot-dip galvanized for interior partitions and where partitions connect to exterior walls.

2.10 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Available Manufacturers:
      a. EaCo Chem, Inc., or equal.

B. Non-Acidic Cleaner: Use of acidic cleaners is not permitted on decorative CMU. Provide nonacidic cleaners in accordance CMU manufacturers requirements.

2.11 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Limit cementitious materials in mortar to Portland cement and lime.

B. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For masonry below grade or in contact with earth, use Type M.
   2. For reinforced masonry, use Type S.
   3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

C. Pigmented Mortar: Use colored cement product. Pigments shall not exceed 10 percent of Portland cement by weight.

D. Grout for Unit Masonry: Comply with ASTM C476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
   2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.
   3. Grout compressive strength: 2,000 PSI at 28 Days.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. For the record, prepare a written report, endorsed by Installer, listing conditions detrimental to performance of work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

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

3.02 GENERAL INSTALLATION

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed. Do not use units cut to less than one-half size.

E. Do not install concrete masonry units with damage to the face. Do not install brick units which will show defects after installation.

F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

G. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
   1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
   6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

3.03 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs. Prior to installation review bond pattern with Engineer.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

F. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated. Use specified grout stop to contain grout within specified limits.

G. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.
   3. Wedge non-load-bearing partitions against the structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

H. Where walls intersect with a T configuration, connect the intersecting wall with rigid anchors unless otherwise indicated. Space anchors at 24 inches on center with ends embedded in grouted cores.

3.04 MORTAR BEDDING AND JOINTING

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

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is necessary, remove mortar and replace.

3.05 CAVITY WALLS

A. Bond wythes of cavity walls together using wire ties designed to engage pintle and eye connected to joint reinforcement. Space wire ties at 16 inches on center vertically and horizontally. Wire ties shall project at least halfway into veneer, with a minimum mortar cover of 5/8 inch at the exterior surface.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Coordinate and allow access for air and vapor barrier membrane to be furnished and installed by the Waterproofing, Dampproofing, and Caulking Contractor under Section 07270 – Air and Water Barriers.

D. Cavity walls shall be insulated with materials as specified herein.
   1. The backup block shall be erected first and the wire reinforcing installed as the work progresses.
   2. Joints of the backup block wall shall be struck off smooth and level.
   3. After the fluid applied air and vapor barrier has been applied by Section 07270, the insulation shall be placed on the lower row of the reinforcing and shall be adhered to the wall with mastic adhesive as recommended by the manufacturer.
   4. All edges of the insulation shall be thoroughly buttered with mastic.

3.06 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches. Space reinforcement not more than 16 inches o.c.

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.07 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
   1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.08 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers with masonry-veneer anchors to comply with the following requirements:

1. Connect veneer to joint reinforcement with wire ties designed to engage pintle and eye projecting from wall joint reinforcement. Wire ties shall project at least halfway into veneer, with a minimum mortar cover of 5/8 inch at the exterior surface.
2. Embed tie sections in masonry joints. Provide air space indicated on the Drawings between back of masonry veneer and face of insulation.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors at 16 inches o.c. vertically and horizontally.

3.09 CONTROL JOINTS

A. General: Install control joint materials in unit masonry as masonry progresses. Do not allow materials to span control joints without provision to allow for in-plane wall or partition movement except that structural bond beams shall be continuous through joints.

B. Form control joints in concrete masonry using one of the following methods:
1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
5. Terminate joint reinforcement at each side of control joints. Structural bond beams shall be continuous through control joints.

C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod furnished and installed by the Waterproofing, Dampproofing, and Caulking Contractor as specified in Section 07920 – Joint Sealants, but not less than 3/8 inch.

D. Omit mortar from vertical control joints and place rubber control joint material as wall is constructed. Joint sealant shall be furnished and installed under Section 07920 - Joint Sealants, by the Waterproofing, Dampproofing, and Caulking Contractor.

E. Joints around the perimeter of doors, louvers, and window frames shall be provided so as to receive the placement of joint sealant furnished and installed under Section 07920 - Joint Sealants, by the Waterproofing, Dampproofing, and Caulking Contractor.

3.10 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install embedded, base-wall and through-wall flashing as follows, unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. When flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At multi-wythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe. Form 1/4-inch hook in edge of flashing embedded in inner wythe.
   3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge covered with elastomeric membrane, lapping at least 4 inches.
   4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

C. Roof penetrating flashing including, but not limited to, metal gravel stop shall be furnished and installed by the Roofing and Flashing Contractor under Section 07620 – Metal Flashing and Trim.

D. Install metal drip edge plate in accordance with architectural details and manufacturer's requirements.

E. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
   1. Use specified weep/vent products to form weep holes.
   2. Space weep holes 24 inches o.c., unless otherwise indicated.

F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

G. Install vents in head joints in exterior wythes at spacing indicated.

3.12 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage and pay the costs associated with a qualified independent testing agency to perform field tests indicated below and to prepare test reports. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

B. Testing Frequency: One set of tests will be completed by the testing agency for each 5000 sq. ft. of wall area or portion thereof. Masonry Contractor shall be responsible for identifying when testing is required and to coordinate with the General Contractor and Engineer/Owner. The Engineer/Owner will schedule and provide payment to the independent testing agency. Test types shall include the following for the Contractor's reference:

1. Mortar Test: For each type of mortar, test per ASTM C780. Test mortar for air content (ASTM C91), compressive strength (ASTM C109/109M), and water retention (ASTM C1506). Provide results from compressive strength tests for one (1) test at 7 days and two (2) tests at 28 days.
2. Grout Test: Test per ASTM C1019. Test for slump (ASTM C143/143M) and compressive strength (ASTM C109/109M). Provide results from compressive strength tests for one (1) test at 7 days and two (2) tests at 28 days.
3. Prism Test – Test one (1) set of three (3) prisms per ASTM C1314. Test one (1) prism at 7 days and two (2) prisms at 28 days.

3.14 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, around penetrations and where indicated. Sealants shall be provided by the Waterproofing, Dampproofing, and Caulking Contractor under Section 07920 – Joint Sealants.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Engineer's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent non masonry surfaces from contact with cleaner by covering them. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.15 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove any and all masonry related materials from Project site. Clean areas of staging and scaffolding and prepare in accordance with General Contractor’s requirements.

END OF SECTION

INDEX

DIVISION 5 METALS

SECTION 05101

MISCELLANEOUS AND ORNAMENTAL IRON (METAL FABRICATIONS) FILED SUB-BIDS

PART 1 GENERAL

1.01 METAL FABRICATIONS FILED SUB-BID

A. The work of the following sections requires a filed sub-bid in accordance with M.G.L. C.149, S.44A through 44H, inclusive, as amended. These sections will be covered under a single filed sub-bid for the Miscellaneous and Ornamental Iron (Metal Fabrications) category of work.
   1. Section 05500 – Metal Fabrications

B. Reference Drawings: The work of this Section is shown on the following Drawings:
   1. 01-A-1 through 01-A-3, 20-A-1 through 20-A-18, 99-A-1 through 99-A-3
   2. 01-S-01, 20-S-1 through 20-S-30
   3. 20-D-1 thru 20-D-16; 99-D-1 thru 99-D-4

C. Requirements of Submitting Sub-bids:
   1. Sub-bids for work under this Section shall comply with the requirements of M.G.L. C.149, S.44D and 44F; shall be filed in a form furnished by the Awarding Authority, in a sealed envelope, at the time and place stipulated in the Advertisement for Bids and Information for Bidders; and shall be accompanied by a Bid Deposit in the amount of five percent of the sub-bid price complying with the requirements of M.G.L. C.149, S.44B(2). The following should appear on the upper left-hand corner of the envelope:

      SUB-BIDDER: Contractor Name

      SUB-BID FOR: Miscellaneous and Ornamental Iron

      PROJECT: Wading River WTP
      Contract No. 10, DWSRF No. 16764

D. SUB-SUBLISTINGS

   1. Sub-sub trades are categories of work within a filed sub-bid trade and are indicated in paragraph E on the Form for Sub-bid. If sub-sub trades are requested and identified follow the instructions below. The proposed contract price submitted by the filed sub-bidder on the Form for Sub-Bid includes the cost of any sub-sub trades**.**

      a. Sub-sub bids are required for the following subcategories of this section:

Class of Work	Reference Paragraph

   2. Sub-bidders shall include the appropriate information for the above listed sub-categories in Paragraph E of the Form for Sub-bid.

3. If the filed sub-bidder customarily performs the above work with its own workforce the sub-bidder should list its own name and trade, and leave the dollar amount blank.

4. If the filed sub-bidder does not customarily perform the above work with its own workforce the sub-bidder should list the name of the contractor performing the work, the trade and insert a dollar amount.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: Provide all structural steel and appurtenances that are required by the Contract Documents. Metal fabrications not included in the Miscellaneous and Ornamental Iron Filed Sub-bid under Specification Section 05500 shall be furnished and installed by the General Contractor under this specification.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A Including but not necessarily limited to:
1. Anchor bolts.
2. Leveling plates.
3. Other items required to anchor the structural framing to the concrete or masonry work.

B Supply the above mentioned items to the respective trades, at the proper time, for installation in the Work.

1.03 RELATED WORK

A Documents affecting the work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
1. Section 03300 Cast-In-Place Concrete.
2. Section 03345 Concrete Placing, Curing, and Finishing
3. Section 04200 Unit Masonry
4. Section 05220 Steel Joists

1.04 APPLICABLE STANDARDS

A. Conform to the latest editions of the following standards, unless otherwise specified herein:
1. AISC (American Institute of Steel Construction):
   a. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
   b. Specification for Structural Joints Using ASTM A325 or A490 Bolts.
   c. Code of Standard Practice for Steel Buildings and Bridges (As modified herein).
   d. Quality Criteria and Inspection Standards.
   e Structural Steel Detailing.
2 ASTM (American Society of Testing and Materials):
   a. A36, Standard Specification for Structural Steel.
   b. A53, Standard Specification for steel pipes.
   c. A123, Standard Specification for Zinc (Hot Dipped Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip.

d. A307, Standard Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners.
e. A325: Standard Specification for High Strength Bolts for Structural Steel Joints Including Suitable Nuts and Plain Hardened Washers.
f. A490, Standard Specification for Quench and Tempered Alloy Steel Bolts for Structural Steel.
g. A496, Specifications for Steel Wire, Deformed, for Concrete Reinforcement.
h. A500, Specifications for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
i. A572, Specifications for Grade 50 rolled shapes.
j. A588, Specifications for High-Strength Low-Alloy Structural Steel with 50 ksi Minimum Yield Point to 4-Inches Thick.
k. A992, Standard Specification for Structural Steel Shapes

3. AWS (American Welding Society).
   a. D1.1, Structural Welding Code.
4. SSPC (Structural Steel Painting Council).
   a. Systems and Specifications.
5. All applicable Local and State codes and regulations.

1.05 SUBMITTALS

A Comply with pertinent provisions of Section 01300.

B. Submittals:
1. Shop Drawings:
   a. Erection drawings.
   b. Base plate setting drawings.
   c. Show all shop and erection details including cuts, copes, connections, holes, bolts, surface preparation, painting, and grade of steel.
   d. Indicate size, weight, spacing and elevation of all members; type and location of shop and field connections; type, size and extent of all welds and welding sequence including welding symbols adopted by the American Welding Society.
   e. Submitted beam connections shall be designed for reactions taken as 1/2 the Maximum Total Uniform Load in Table 3-6 in the Fourteenth Edition of the AISC Steel Construction Manual.
   f. Shop drawings must be reviewed by Engineer prior to fabricating structural steel.
2. Substitutions: Submit substitutions of sections or modification of details with the shop drawings. Coordinate approved substitutions, modifications and necessary changes in related portions of the work. Accomplish at no additional cost to the Owner.
3. Method of Tightening High-Strength Steel Bolts: Before erection of structural steel, submit the proposed method of tightening of high-strength steel bolts.
4. Mill Tests: Submit Certificates of Compliance for each grade of steel used and bolts, nuts and washers.
   a. For steel furnished, submit certified mill test reports or reports of tests made by the fabricator or a testing laboratory in accordance with ASTM A6 or A568.

b. For fasteners, provide manufacturer's mill test reports (inspection certificates) for fasteners to be accepted, certification numbers must appear on product containers and correspond to identification numbers on mill test reports. Manufacturer's symbol and grade markings must appear on all bolts and nuts

5. Welders' Qualifications: Submit copies of all welders' certifications.
6. Field Quality Control: Submit field quality control procedures.
7. Fabricator Certification: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD. Submit documentation verifying current certification.
8. Fabricator Inspection: In-plant fabrication shall be inspected by an independent inspection agency employed by the structural steel fabricator. Submit inspection reports prior to delivery of structural steel.
9. Shop Primer: Submit product data for primer proposed for use. Indicate compatibility with finish paint required in Section 09900 – Painting.
10. Certification of Compliance: After completion of fabrication, the fabricator shall submit a letter certifying that the fabricated structural steel conforms with the Contract Documents for the project.

1.06 QUALITY ASSURANCE

A. Steel Members:
1. Steel members found deficient in specified requirements shall be brought to an acceptable condition at no additional cost to the Owner.
2. Damaged material and material not conforming to the Contract Documents shall be rejected by the Engineer at any time nonconformity's are discovered.
3. Remove rejected materials and replace without additional cost to the Owner.

B. Shop Painting:
1. Prior to acceptance of steel, surface preparation and dry film thickness of shop primer will be subject to observations by the Engineer.

C. High-Strength Bolting:
1. High-strength bolts shall be installed tightened and inspected in accordance with the procedures outlined in "Specifications for Structural Joints Using ASTM A325 or A490 Bolts".
2. Steel erector shall furnish all equipment required for installation, tightening and inspection at no cost to the Owner.

1.07 QUALIFICATIONS

A. Qualification of Welders: Qualify all welders in accordance with AWS D1.1.

1.08 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on the Drawings prior to fabrication of structural steel members.

1.09 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Delivery: Deliver structural steel to conform to erection schedule. Deliver loose bearing plates, leveling plates, and anchor bolts in advance of other steel.

B. Handling: Handle steel in such a manner to prevent damage to steel member and shop primer.

C. Storage: Store all steel above ground on platforms, skids or other supports and keep from dirt, grease and other foreign matter. Store all fastener components in a manner that affords complete protection from moisture, heat and dirt contamination.

D. Costs for repair or replacement of damaged steel, corroded or damaged fasteners, or fasteners with inadequate lubricant coating shall be paid for by the Contractor.

PART 2 PRODUCTS

2.01 MATERIALS

A. Wide Flange Steel Shapes:
1. Conform to ASTM A992.

B. Structural Steel Shapes and Plates:
1. Conform to ASTM A36 or ASTM A588.

C. Hollow Structural Sections:
1. Conform to ASTM A500, Grade B.

D. Rolled Shapes:
1. Conform to ASTM A572, Grade 50

E. Welding Electrodes:
1. Conform to AWS type E70.

F. High Strength Steel Bolts, Nuts and Washers:
1. Conform to ASTM A325 typically, A490 where indicated.

G. Plain Bolts, Nuts and Washers (Wood to Steel, Concrete or Masonry Connections):
1. Conform to ASTM A307.

H. Anchor Rods:
1. Conform to ASTM F1554 Grade 36 unless noted otherwise on the Drawings.
2. Hot-dipped galvanized in accordance with ASTM A123
3. Threads to be “chased” so that nuts will work freely.

I. Shear Connectors:
1. Conform to ASTM A108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

J. Deformed Bar Anchors:
1. Conform to ASTM A496, Type C studs.

K. Galvanized Steel:
1. Hot dip galvanize all structural steel columns, beams, lintels, hardware, miscellaneous metal and connections after fabrication in accordance with ASTM A123.

L. Shop Primers:
   1. Shop prime all structural steel, joists, prefabricated trusses, stairs, and miscellaneous ferrous metals, including all galvanized products, with rust inhibitive inorganic zinc gray primer compatible with finish paint as specified in Section 09900 – Painting.
   2. Primer shall be Tnemec 90-97 zinc rich primer, or approved equal, but shall be coordinated with the General Contractor and Painting Contractor to confirm its compatibility with the field coatings being provided by the Painting Contractor on top of the shop primer.

2.02 FABRICATION

A. General: Unless specified otherwise, fabricate steel to conform to AISC's "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings," and "Code of Standard Practice for Steel Buildings and Bridges," the design drawings and applicable building codes and ordinances.

B. Punching: Punch holes clean without torn or ragged edges. Remove sharp fins before bolting. Punch steel for attachments of wood nailers, anchors or for other trades as shown.

C. Existing Structures: Prior to fabrication, verify all pertinent dimensions of any existing structures and foundations affecting new steel, including the anchor bolt dimensions.

D. Anchor Bolts: The use of rolled thread bolts with the tension area less than the diameter shown on the Drawings will not be permitted. Furnish heavy hex nut and hardened washer with all anchor bolts.

E. Bearing Surfaces: Mill bearing surfaces in accordance with AISC Section M2.8. Mill surfaces at column splices and column to base plate connections if gaps exceed tolerances allowed in accordance with AISC Section M4.4.

2.03 SHOP PAINTING

A. General: Shop prime structural steel, steel joists and all metal fabrications, including all galvanized steel as required by the Contract Documents, before delivery to the job site.
   1. Do not ship steel until prime coat is thoroughly dry.
   2. For steel members embedded in concrete or masonry, shop primer shall extend 2 inches into the concrete or masonry on the exposed steel member. The remainder of steel that is embedded will be unprimed.

B. Surface Preparation: Structural steel shall be given a commercial blast and thoroughly cleaned prior to painting in accordance with the Steel Structure Painting Council's Surface Preparation Specification No. SP6.

C. Shop Priming: Apply primer in accordance with manufacturer's application instructions.
   1. Prior to priming remove residual deposits resulting from cleaning.
   2. Apply prime coat as soon as possible after cleaning, and before deterioration of surface occurs.
   3. Do not allow elapsed time between cleaning and priming to exceed two hours.

4. Primer shall be applied to produce a minimum dry film thickness of 2-3 mils.
5. Coat surfaces inaccessible after assembly with two coats to produce the minimum dry film thickness indicated above.

2.04 CONNECTIONS

A. General: High strength bolt or weld all connections unless specified otherwise.
1. Design connections to develop reactions and forces shown on the design drawings.
2. Design connections in accordance with AISC standards.
3. The following connections are slip critical and shall be figured at friction (F) values:
   a. Connections of beams and girders to columns.
   b. Bolted moment connections.
   c. Bracing members.
   d. Hangers.
4. Design of connections shall be performed by or under the direct supervision of a registered professional engineer, qualified to perform the work in the state where the project is located.
5. Shop drawings shall be signed and stamped by this registered professional engineer.
6. Notwithstanding any provision to the contrary in the AISC "Code of Standard Practice for Steel Buildings and Bridges" or in this division, all connections designed by the fabricator shall be its responsibility and review of shop drawings by the Owner or Engineer shall not relieve fabricator of this responsibility.
7. Provide not less than two bolts per connection or large enough to develop 10 kips.
   a. Remove burrs, pits and other defects from contact surfaces of connections.

B. High-Strength Bolted Connections:
1. Assemble high strength bolted connections in accordance with "Specifications for Structural Joints Using ASTM A325 or A490 Bolts."
2. Unless otherwise noted on the Contract Documents, design high strength bolted connections as bearing type with threads in shear planes.
3. Bolts shall be tightened to snug-tight condition unless otherwise noted on Drawings.

C. Plain Bolted Connections:
1. Make connections for secondary members such as girts, framed roof opening and roof struts between purlins with A325 bolts.
2. Tighten nuts to provide adequate strength for connection without overstressing bolts.

D. Welded Connections:
1. Execute welding with welders qualified in accordance with requirements outlined in Part 1 of this Section.
2. Perform welding as specified in AWS D1.1.
3. Provide as much welding in the shop as practical.
4. Field welding is permitted only if specifically indicated on the Drawings or approved by the Engineer.

E. Beam Reactions:
1. Unless beam reactions are shown, each beam connection shall be designed to support one half of the total uniform load capacity of the beam for the given shape, span and steel specified.
2. Provide 5/16" fitted stiffener plate each side of steel beam web where hangers or posts occur.

F. Diagonal Bracing Forces:
1. Unless diagonal bracing forces are shown, each diagonal connection shall be designed to resist the full strength of the member in tension.

G. Double angles:
1. Shall be connected together intermittently if their unsupported length exceeds the maximum permitted by AISC Specifications Section E4.

2.05 GALVANIZED FABRICATION

A. Steel members and fabrications to be galvanized after fabrication shall be hot dip galvanized in accordance with the Galvanized Fabrication requirements in Specification Section 05500, Metal Fabrications.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verifying Existing Conditions Ready to Accept Work:
1. The structural steel contractor shall check in-place bearing conditions prior to the erection of any structural steel, the level and location of all bearing surfaces and anchor bolts. Any deficiencies shall be brought to the attention of the General Contractor and he shall correct them to the satisfaction of the structural steel contractor.
2. Installer shall accept existing conditions prior to beginning installation.

3.02 ERECTION

A. General:
1. The Contractor shall notify the Engineer a minimum of 24 hours in advance of all steel erection operations.
2. Provide all erecting tools, equipment, shores and bracing needed for the erection of structural steel and related items.
3. Provide 3/4-inch thick non-shrink, non-metalic grout and 1/4-inch thick leveling plates under all column base plates.
4. Bolt steel work in place as erected.
5. Straighten and plumb structure and check with surveying instruments.
6. Do not use drift pins in a manner that will damage the metal.
7. Where beams bear on masonry or concrete provide steel bearing plates. Where beams bear on hollow core masonry, fill the blocks with grout at bearing and/or anchorage of bolts two (2) blocks deep and two (2) blocks wide; or fill the top two (2) courses with grout continuously.
8. All beams and columns encased in masonry units shall be covered with mastic asphalt or pitch 1/8-inch thick.
a. All columns encased in continuous masonry units shall be provided with straps to engage wire anchors at 24 inches on center. Provide

Hohmann and Barnard 359FH straps shop welded to column surfaces to engage 3/16-inch Hohmann and Barnard 202W Column Ties.

9. Protect all base plates with two (2) coats of bitumastic.

B. Shop Errors:
   1. Immediately report to Engineer any errors in shop fabrication or deformation resulting from handling and shipping.
   2. Obtain Engineer's approval of method of correction before proceeding with work.
   3. Make approved corrections without additional cost to the Owner.
   4. Slight inaccuracies in matching connection holes may be corrected by reaming.
   5. The use of gas-cutting torches in the field for correcting fabrication errors will not be permitted without prior approval of Engineer.

C. Shores and Bracing:
   1. Use temporary shores and bracing during progress of the work to support all loads to which the structure may be subjected.
   2. In cases where permanent stability of steel depends on other parts of the building, such as masonry and concrete work, thoroughly brace and keep steel frame work plumb and in position against wind, weather or other damaging conditions.
   3. Leave shores and bracing in place as long as required for safety and to maintain plumbness and true alignment.
   4. Do not remove temporary bracing untill permanent bracing has been installed.

3.03 TOLERANCES

A. Do not exceed the tolerances permitted by AISC "Codes of Standard Practice for Steel Buildings and Bridges."
   1. Exercise care to insure that individual member tolerances do not accumulate in the completed structure.

B. Errors of detailing and fabrication are the responsibility of the Contractor.

3.04 FIELD PAINTING

A. General:
   1. Clean all surfaces prior to painting.
   2. Field coat and touch up primer on all damaged surfaces using same primer as was used in the shop.
   3. Intermediate and finish painting of all steel members, including all galvanized steel, shall be provided by the Painting Contractor under Section 09900 – Painting.

END OF SECTION

SECTION 05220

STEEL JOISTS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Included: Provide steel joists as required by the Contract Documents.
   1. In general the work includes all labor, materials and equipment necessary to complete the work of this Section, without limiting the generality thereof includes:
      a. Open web steel joists with bridging, attached seat, and anchors.
      b. Loose bearing plates and anchor bolts for site placement.
      c. Framed floor and roof openings greater than 18-inches.

1.02 RELATED WORK

A. Documents affecting the work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   1. Section 05120 Structural Steel
   2. Section 05311 Steel Deck
   3. Section 05500 Metal Fabrications

1.03 REFERENCES

A. Conform to the latest editions of the following standards, unless otherwise specified herein:
   1. ASTM (American Society of Testing and Materials).
      a. A108 Steel bars, Carbon, Cold Finishing, Standard Quality
      b. A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
      c. A307 Carbon Steel Externally Threaded Standard Fasteners
      d. A325 High Strength Bolts for Structural Steel Joints
   2. AWS (American Welding Society).
      a. D1.1 Structural Welding Code
   3. SJI (Steel Joist Institute).
      a. Standard Specifications for Open Web Steel Joists K Series
      b. Standard Specifications for Longspan Steel Joists LH and LJ Series and Deep Longspan Steel Joists DLH and DLJ Series.
   4. SSPC (Steel Structures Painting Council).
   5. FS TT-P-636 Primer Coating Alykd, Wood and Ferous Metal
   6. All applicable Local and State codes and regulations.

1.04 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the

specified requirements and the methods needed for proper performance of the work of this Section.

B. Perform work in accordance with SJI Standard Specifications, Load Tables and Weight Tables, including headers and other supplementary framing.
   a. Maintain one copy of each document on site.

C. Provide all products of this Section from a manufacturer, who specializes in the production of this type of work.
   a. Damaged material and material not conforming to the Contract Documents shall be rejected by the Engineer at any time nonconformity's are discovered.
   b. Remove rejected materials and replace without additional cost to the Owner.

1.05 SUBMITTALS

A. Comply with pertinent provisions of Section 01300.

B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
   1. Shop drawings: Indicate standard designations, configurations, sizes, spacing, and locations of joists, leg extensions, joist coding, bridging, connection attachments, and cambers.
   2. Welder's Certificates: Submit manufacturer's certificates under provisions of Section 01410 that welders employed on work have met AWS qualifications within the previous twelve (12) months.

C. Submit verification of fabricator membership in the Steel Joist Institute.

D. Certification of Compliance: After completion of fabrication, the fabricator shall submit a letter certifying that the fabricated steel joists conform with the Contract Documents for the project.

1.06 QUALIFICATIONS

A. Fabricator: Member of the Steel Joist Institute. Company specializing in performing the work of this Section with minimum ten (10) years of documented experience.

B. Erector: Company specializing in performing the work of this Section with minimum five (5) years of documented experience.

C. Design connections not detailed on the Drawings under direct supervision of a registered Professional Structural Engineer experienced in design of this work.

1.07 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Deliver, store and protect products to site under provisions of SJI requirements.:

B. Handling:
   1. Handle joists in such a manner to prevent damage to the finish.
   2. Protect joists from distortion or damage.

C. Storage:
   1. Store all joists above ground on platforms, skids or other support, and keep from dirt, grease and other foreign matter.

1.08 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on shop drawings.
   1. Report any discrepancies between field measurements and Drawings to the Engineer as soon as any discrepancies are identified.
   2. Installation of all steel framing members associated with this Specification Section shall not begin until all discrepancies are resolved.

PART 2 PRODUCTS

2.01 MATERIALS

A. Open Web Joist Members: SJI Type K Open Web

B. Anchor Bolts, Nuts and Washers: ASTM A307.

C.

D. Structural Steel for Supplementary Framing and Joist Leg Extensions: ASTM A36.

E. Welding Materials: AWS D1.1: type required for materials being welded.

2.02 FABRICATION

A. All joists and associated fabrications shall be hot dip galvanized in accordance with the Galvanized Fabrication requirements in Specification Section 05500, Metal Fabrications.

B. Provide bottom and top chord extensions as indicated.

C. Frame special sized openings in joist chord framing as detailed.

2.03 FINISH

A. Primer: Tnemec 90-97 zinc rich primer or as required for galvanized steel. Coordinate primer with the General Contractor and Painting Contractor so that primer is compatible with the intermediate and finish coat painting systems being provided by the Painting Contractor under Section 09900.

B. Testing and analysis of components will be performed under provisions of Section 01410.

C. Intermediate and finish coatings shall be furnished and field applied by the Painting Contractor under Section 09900 – Painting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Installer shall accept all existing conditions prior to beginning installation.

3.02 ERECTION

A. Erect and bear joists on supports.

B. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Coordinate placement of anchors in concrete construction for securing bearing plates and angles.

D. After joist alignment and installation of framing, field weld joist seat to bearing plates, angles.

E. Position and field weld joist chord extensions and wall attachments, as detailed.

F. Frame floor and roof openings greater than eighteen (18)-inches with supplementary framing.

G. Do not permit erection of decking until joists are braced, bridged and secured.

H. Do not field cut or alter structural members without approval of joist fabricator.

I. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete or scheduled to be fireproofed.

3.03 ERECTION TOLERANCES

A. Maximum variation from plumb: 1/4-inch.

B. Maximum offset from true alignment: 1/4-inch.

END OF SECTION

SECTION 05311

STEEL DECK

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: Provide galvanized steel roof deck and accessories as required by the Contract Documents.
   1. In general the work includes but is not necessarily limited to providing galvanized steel decking to be anchored to the supporting joist system, formed steel cant strips as required, framing for all openings, and any misc. bearing plates and angles required to complete the steel decking.

1.02 RELATED WORK

A. Documents affecting work of this Section include but are not necessarily limited to General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   1. Section 05120 Structural Steel
   2. Section 05220 Steel Joists

1.03 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. To be installed by a company specializing in performing the work of this Section with a minimum of three (3) years documented experience and approved by manufacturer.

C. Steel deck manufacturer shall be a member of the Steel Deck Institute.

1.04 REFERENCES STANDARDS

A. Current edition of each shall apply.
   1. ASTM A36/A36M - Structural Steel.
   2. ASTM A653 - Steel Sheet, Zinc-Coated, Galvanized by the Hot-Dip Process.
   3. ASTM A611 - Steel, Cold-Rolled Sheet, Carbon, Structural.
   4. AWS D1.3 - Structural Welding Code.
   5. FM - Roof Assembly Classifications.
   6. SDI (Steel Deck Institute) - Design Manual for Composite Decks, Form Decks, Roof Decks, Cellular Metal Floor Deck with Electrical Distribution.
   7. SSPC (Steel Structures Painting Council) - Painting Manual.
   8. UL - Fire Resistance Directory.

1.05 PERFORMANCE REQUIREMENTS

A. Provide as a minimum the decking and connections shown on the Drawing.
   1. Design metal deck in accordance with SDI Design Manual.

1.06 SUBMITTALS

A. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.

B. Product Data: Provide deck profile characteristics and dimensions, structural properties, and finishes.

C. Certificates: Certify that Products meet or exceed specified requirements.

D. Submit manufacturer's installation instructions.

E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.07 DELIVERY, STORAGE AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage and handling.
   1. Bundles must be protected against condensation with a ventilated waterproof covering.
   2. Bundles must be stored off the ground.
   3. Deck bundles placed on the building frame must always be placed near a main supporting beam at a column or wall.
   4. In no case are the bundles to be placed on unbolted frames or on unattached and un-bridged joists.

PART 2 PRODUCTS

2.01 MATERIALS

A. Sheet Steel: ASTM A446, Grade A Structural Quality; with G90 galvanized coating conforming to ASTM A525.

B. Bearing Plates: ASTM A36 steel, Galvanized.

C. Welding Materials: AWS D1.3.

D. Touch-Up Primer for Galvanized Surfaces: SSPC 20, Type I Inorganic, zinc rich.

2.02 FABRICATION

A. The steel deck units shall be fabricated from galvanized steel conforming to Section A3 of the latest edition of the American Iron and Steel Institute, Specifications for the Design of Cold-Formed Steel Structural Members.
   1. Steel used shall have a minimum yield strength of 33 ksi.

B. Floor Deck:
   1. 1" deep x 22 gage (0.0299 inch) thick non-composite form deck.
   2. Galvanized steel sheet ASTM A653, Structural Steel, Grade 80, with G90 zinc coating.

C. Roof Deck:
   1. 1-1/2" deep x 20 gage (0.0359 inch) thick wide rib (Type B) roof deck.
   2. Galvanized steel sheet ASTM A653, Structural Steel, Grade 80, with G90 zinc coating.

D. Related Deck Accessories:
   1. Metal closure strips, wet concrete stops, cover plates, cant strips, 20-gage-thick galvanized sheet steel; of profile and size as indicated.

E. Shop Primer:
   1. Shop prime all materials with Tnemec 90-97 zinc rich primer, or approved equal. Primer shall be coordinated with the General Contractor and Painting Contractor to confirm its compatibility with the field coatings being provided by the Painting Contractor on top of the shop primer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine support framing and field conditions for compliance with requirements and installation tolerances and other conditions affecting performance of work of this Section.

B. All OSHA, State and Local rules for erection must be followed.

3.02 INSTALLATION

A. Install deck panels and accessories according to SDI Specifications, SDI Manual of Construction with Steel Deck, and in accordance with the approved erection layout drawing.

B. Place deck panels on structural supports and adjust to final position with ends lapped over structural supports with a minimum end bearing of 1 ½-inches.
   1. Attach the deck panels firmly to the supports immediately after placement in order to form a safe working platform.

C. Cut and neatly fit deck and accessories at skew conditions, around openings and other work projecting through or adjacent to the decking.
   1. Reinforce steel deck openings from 6 to 18 inches in size with 2 x 2 x 1/4-inch steel angles.
   2. Place framing angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and weld to deck at each flute.
   3. Install sheet steel closures and angle flashing to close openings between deck and walls, columns, and openings.
   4. Openings not shown on the erection drawings, such as those required for stacks, conduits, plumbing, vents, etc. shall be cut, and reinforced if necessary, by the trades requiring the openings.

3.03 ATTACHMENT

A. Anchor deck units to steel supporting members by arc spot puddle welds with welding washers, or approved mechanical fasteners.
   1. Arc spot puddle welds shall be 5/8-inch minimum visible diameter with the attachment pattern shown on placement drawings.
      a. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with ZRC Cold Galvanizing Compound.

END OF SECTION

SECTION 05400

COLD FORMED METAL FRAMING

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Included: Provide cold formed metal framing as required by the Contract Documents.
   1. In general the work includes all labor, materials, tools, and equipment to provide light gauge metal framing and accessories.

1.02 RELATED WORK

A. Documents affecting the work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   1. Section 05120 Structural Steel
   2. Section 06100 Rough Carpentry

1.03 APPLICABLE STANDARDS

A. Conform to the latest editions of the following standards, unless otherwise specified herein:
   1. ASTM, (American Society of Testing and Materials).
      a. A446, 50 ksi or higher.
   2. 1.04.02 American Iron and Steel Institute (AISI) Cold Formed Steel Design Manual “Specifications for the Design of Cold-formed Steel Structural Members.
   3. All applicable Local and State codes and regulations.

1.04 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Provide all products of this Section from a manufacturer, who specializes in the production of this type of work.
   1. Damaged material and material not conforming to the Contract Documents shall be rejected by the Engineer at any time nonconformity’s are discovered.
   2. Remove rejected materials and replace without additional cost to the Owner.

1.05 SUBMITTALS

A. Comply with pertinent provisions of Section 01300.

B. Product data: Within 35 calendar days after the Contractor has received the Owner’s Notice to Proceed, submit:

1. Manufacturer's specifications and installation instructions. Include manufacturer's certification as may be required to show compliance with these Specifications.
2. Fabrication and erection drawings.

1.06 QUALIFICATIONS

A. Qualification of Welders:
1. Qualify all welders in accordance with AWS D1.3 (Specification for Welding Sheet Steel in Structures).

1.07 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Delivery:
1. Deliver cold formed metal framing to conform to framing schedule.

B. Handling:
1. Handle steel framing members in such a manner to prevent damage to the galvanized finish.

C. Storage:
1. Store all steel framing above ground on platforms, skids or other support, and keep from dirt, grease and other foreign matter.

1.08 FIELD MEASUREMENTS.

A. Verify that field measurements are as shown on Drawings.
1. Report any discrepancies between field measurements and Drawings to the Engineer as soon as any discrepancies are identified.
2. Installation of all steel framing members associated with this Specification Section shall not begin until all discrepancies are resolved.

PART 2 PRODUCTS

2.01 MATERIALS

A. METAL FRAMING
1. All light gauge metal and joist framing members shall be of the type, size and gauge as shown on the drawings or specified in this Section.
2. Unless noted otherwise on the Drawings the minimum gage thickness of the framing members shall be fourteen (14).
3. All light gauge metal framing and joists shall be galvanized (G60) and formed from steel that meets the requirements of ASTM A446, Grade D, with a minimum yield of 55,000 psi.
4. All purlins and girts shall be galvanized (G90) in accordance with ASTM A653.
5. Flanges shall be 1 5/8-inches, unless otherwise noted on the Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Installer shall accept all existing conditions prior to beginning installation.

3.02 INSTALLATION

A. General:
1. Axially loaded studs shall be installed so the ends are positioned against the inside of the runner track web prior to fastening and shall be attached to both flanges of the upper and lower runner track.
2. All framing components shall be cut squarely for attachment to perpendicular members or, as required, for an angular fit against abutting members.
3. All framing components shall be plumbed, aligned and leveled.
4. Fastening of components shall be with self-drilling screws or welding. Screws and welds shall be of sufficient size to insure the strength of the connection.
5. All welds or other abraded areas shall be touched-up with ZRC cold galvanizing compound or an approved equal.
6. In all doubled jamb studs and doubled headers not accessible for installation of insulation after erection, insulation equal to that specified shall be provided.
7. Splices in framing components, other than runner track, are not allowed.
8. Abutting lengths of runner shall be butt-welded, spliced or each length securely anchored to a common structural element.
9. Temporary bracing where required shall be provided until erection is complete.
10. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar construction.
11. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement, at locations indicated below.
    a. Where edges of suspended ceilings abut building structure horizontally at ceiling perimeters or penetration of structural elements.
    b. Where partition and wall framing abuts overhead structure
        i. At curtain walls provide slip or cushioned type joints to attain lateral support and avoid axial loading.
12. Do not bridge building expansion and control joints with steel framing or furring members; independently frame both sides of joints with framing or furring members or as indicated.

3.03 INSTALLATION OF STEEL FRAMING FOR WALLS AND PARTITIONS

A. Install runners (tracks) at floors, ceilings and structural walls and columns where wall stud system abuts other construction.
1. Where studs are installed directly against exterior walls, install asphalt felt strips between studs and wall.

B. Installation Tolerances: Install each steel framing and furring member so that fastening surface do not vary more than 1/8 inch from plane of faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings.

1. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for finish materials.

D. Install steel studs and furring in sizes and at spacings indicated but not less than that required by referenced steel framing installation standard.
   1. For single layer construction: 16 inches on center.

E. Install steel studs so that flanges point in the same direction.

F. Frame door openings to comply with details indicated, with GA-219 and with applicable published recommendations of gypsum board manufacturer.
   1. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames.
   2. Install runner track section (for cripple studs) at head and secure to jamb studs.

G. Frame openings other than door openings to comply with details indicated, or if none indicated, in same manner as required for door openings.
   1. Frame below sills of openings to match framing required above door heads.

3.03 INSTALLATION OF STEEL FRAMING FOR FLOOR JOISTS

A. Install tracks at structural wall connection locations as shown on the Drawings.

B. Installation Tolerances: Install each steel framing member so that fastening surface do not vary more than 1/8 inch from plane of faces of adjacent framing.

C. Install floor joists at 16-inches on center, unless otherwise noted on the Drawings.

D. Joists shall be plumbed, aligned and securely attached to the flanges or webs of the tracks
   1. Clip angles shall be provided at all connections to track.

E. Install floor joists so that flanges point in the same direction.

F. Provide web stiffeners at all bearing locations.

G. Joist Bridging:
   1. Provide 16 gauge solid bridging in first two and last two joist spaces.
      a. Solid bridging shall not be less than two (2) inches maximum reduction to section depth.
   2. Starting at third joist space, install V-bar bridging at the bottom of the floor joists, extending for a 10 ft. run.
      a. Metal decking to brace top of joists
      b. Follow with solid bridging in one space.
      c. Repeat to completion, with each 10 ft. run of strap bridging followed by one space of solid bridging.
      d. All bridging to be welded in place.
   3. Space bridging as shown on the Drawings.
      a. If spacing is not shown on the Drawings space at five (5) feet on center.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

(PART OF WORK OF SECTION 05101 – MISCELLANEOUS AND ORNAMENTAL IRON FILED SUB-BIDS, Filed Sub-Bid Required)

PART 1 GENERAL

1.01 DESCRIPTION

A. The work of this Section includes all labor, materials, tools, scaffolding, and equipment necessary to provide metal fabrications as required by the Contract Documents.

1. In general the work shall include field measurements, fabrication, delivery, and installation (unless noted otherwise) of required items including, but not necessarily limited to, the following:
   a. Lintels and Ledger/Lintel Angles Attached to Precast Concrete and CMU Lintels (doors, windows, louvers, fans, etc.)
   b. Grating Support Systems Complete (Seat Angles, Channels, Ledgers, Beams, and Beam Brackets)
   c. Angle Clips (associated with Angles, Lintels, and other Metal Fabrications Provided under this Specification Section)
   d. Overhead Coiling Door Jamb and Lintel
   e. Chemical Fill Station Shields
   f. Pipe Bollards and Associated Sleeves
   g. Metal Pan Stairs and Stringers
   h. Aluminum Railings
   i. Stair Nosing
   j. Chemical Corporation Guards
   k. Loading Dock Pipe Swing Gate
   l. Aluminum Ships Ladders
   m. MIEX and GreensandPlus FRP Grating Platforms, Stairs, and Railings (Furnished and Installed by the General Contractor as Part of the MIEX and GreensandPlus Systems, Respectively)
   n. Aluminum Awnings (Furnished and Installed by the General Contractor)
2. Metal fabrications not included in the Miscellaneous and Ornamental Iron Filed Sub-bid under this specification section shall be furnished and installed by the General Contractor under Specification Section 05120 – Structural Steel.

1.02 RELATED WORK:

A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications:

1. Section 03300 Cast-In-Place Concrete
2. Section 04200 Unit Masonry
3. Section 06100 Rough Carpentry
4. Section 09900 Painting

B. Related work not included:
   1. Installation of items imbedded in concrete.
   2. Masonry ties.
   3. Anchor bolts for equipment.
   4. Pipe sleeves.

1.03 COORDINATION

A. The work of this Section shall be coordinated with the work of other Sections, to ensure compatibility before fabrication.
   1. Field measurements shall be taken at the site to verify dimensions and make the required dimension changes before fabrication.

1.04 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Perform shop and/or field welding required in connection with the work of this Section in strict accordance with pertinent recommendations of the American Welding Society.

1.05 SUBMITTALS

A. Comply with pertinent provisions of Section 01300.

B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
   1. Materials list of items proposed to be provided under this Section.
   2. Specifications and other data needed to prove compliance with the specified requirements.
   3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.

C. A copy of this specification section with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
   1. If deviations and clarifications form the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
   2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be stored out of contact with the ground in such manner and location as will prevent damage and deterioration.

PART 2 PRODUCTS

2.01 MATERIALS

A. General:
1. Exposed surfaces shall have smooth finish and sharp, well defined lines and arises.
2. Sections shall be well formed to shape and size with sharp lines and angles; curved work shall be sprung evenly to curves.
3. Castings shall have sharp corners and edges, and shall be clean, smooth and true to pattern.
4. Welding shall be in accordance with the Structural Welding Code of the American Welding Society.
   a. All welding, except as otherwise indicated, shall extend the entire length and depth of joints.
   b. All welded face joints shall be ground flush and smooth.
5. Miscellaneous metal work shall be cut, drilled, countersunk and tapped for the attachment of other work where indicated.
6. Miscellaneous metal work to be built in with concrete or masonry shall be of the form required for anchorage, or shall be provided with anchors or expansion shields.

B. Comply with following standards, as pertinent:

1.	Steel plates, shapes and bars	ASTM A36,
2.	Steel plates to be bent or cold-formed	ASTM A36, Grade C,
3.	Steel tubing (hot-formed, welded or seamless)	ASTM A501,
4.	Hot-dip galvanized anchor bolts and nuts	ASTM A307,
5.	Gray iron castings	ASTM A48, Class 30,
6.	Galvanizing, general	ASTM A123,
7.	Galvanizing, hardware	ASTM A153,
8.	Copper alloys	ASTM B30,
9.	Copper alloy castings	ASTM B584, UNS C84400,
10.	Stainless steel bolts, bars and shapes	ASTM A276, (Type 316L),
11.	Stainless steel plate and sheet	ASTM A666, (Type 316L),
12.	Stainless steel bolts and studs	ASTM F593, (Group 2),
13.	Stainless steel nuts	ASTM F594, (Group 2),
14.	Aluminum: extruded shapes	Alloy 6061-T6,
15.	Aluminum: sheets and plates	Alloy 6061-T6,
16.	Aluminum railing	Alloy 6063-T5, ASTM B429,
17.	Aluminum Grating	ASTM B221, Alloy 6063,
18.	Aluminum Expanded Metal	Alloy (5005-H-34).

C. Galvanized Items:
1. All material that is specified to be galvanized shall be hot-dip galvanized after fabrication, in accordance with ASTM Standard A123, A143, A153, A384 and A385 as applicable with zinc containing 0.5 percent nickel.
2. All steel assemblies including material and welds shall be designed, fabricated and prepared to safeguard against warpage, distortion and embrittlement during galvanizing and for all handling during erection and galvanizing.
3. The galvanizer shall provide a notarized statement indicating compliance with the ASTM Standards and shall stamp 5 pieces.
   a. The stamp shall indicate the ASTM Standard and the coating weight.

4. Galvanized surfaces damaged by welding or other causes shall be repaired in accordance with ASTM A780 by wire brushing to remove all loose or cracked zinc coating and regalvanized with a 95% zinc cold galvanizing coating, as manufactured by Z.R.C. Chemical Products Co., or approved equal.
    a. After installation, galvanized surfaces such as handrails and other areas in contact with flesh or clothing shall be rubbed smooth.

D. Aluminum Items:
1. Aluminum that will be in contact with mortar, masonry, concrete or other absorptive materials shall be protected against galvanic or corrosive action by painting with bituminous paint, or a coat of aluminum paint.
2. Aluminum that will be in contact with dissimilar metals shall be protected by painting the dissimilar metal with a bituminous paint minimum 10 mil thick, except that steel anchors and connecting members are to be stainless steel.
3. All exposed aluminum shall have mill finish, unless otherwise specified.
4. After installation, aluminum surfaces shall be cleaned, following the procedure recommended by the manufacturer.

E. Stainless Steel Items:
1. All material that is required to be stainless steel shall be 316L SS, unless otherwise noted, and shall be in compliance with ASTM A276, ASTM A666, ASTM F593, and ASTM F594.
2. All welding shall be by the shielded arc, inert gas, MIG or TIG method.
3. Butt welds shall have full penetration.
4. All welds shall have a surface finish of a 2-D sheet finish.
5. Brushing of welds shall be done only with a stainless steel brush.
6. Field welding shall not be permitted
7. After fabrication, all stainless steel assemblies and parts shall be passivated by immersion in a pickling solution of 6% nitric acid and 3% hydrofluoric acid at 140 degrees F for a minimum of 15 minutes. Parts shall be free of iron particles or other foreign material. A complete neutralizing operation shall be required by immersion in a tri-sodium phosphate rinse.

2.02 MANUFACTURED UNITS

A. Anchors, Bolts and Inserts.
1. Anchors, bolts and inserts shall be furnished to fasten miscellaneous metal items to concrete, masonry and other surfaces. All anchors and bolts shall be stainless steel unless otherwise shown on the Drawings.
2. Expansion and toggle bolts for the Work to be anchored shall be used where built-in bolts are not practicable. These bolts shall be stainless steel.

B. Railing and Appurtenances.
1. General.
    a. All railing shall be constructed of materials indicated.
    b. Railing shall be constructed in accordance with the requirements of Section 1607.7 of the International Building Code and the U.S. Department of Labor Occupational Safety and Health Administration Standards. Handrails shall be tested per ASTM E935 for design loads.
    c. Railing and pipe sleeve inserts in concrete shall be plastic pipe or tube. Changes in direction shall be made with smooth rounded curves. Joints

shall be mitered and welded, without fittings. Railing splices shall be butted and reinforced by a tight-fitting interior sleeve not less than 6 inches long. Standard pipe flanges shall be provided at ends of rails where indicated. Steel handrails shall be galvanized. Pipe sleeve inserts shall be galvanized to prevent rusting.

d. All wall rails shall be provided with wall returns and wall brackets spaced not more than 4-feet 0-inches on centers, of the same type and finish as the handrails.

2. Aluminum Railings and Handrail:
   a. Aluminum round pipe conforming to MIL-P-25995.
   b. Alloy 6063-T6.
   c. Anodized aluminum finish: AA-M31C21A41 (Mechanical Finish: directional textured, fine-satin; Chemical Finish: etched, fine matt; Anodic Coating: Architectural Class I, clear, natural), per The Aluminum Association publication "Designations for Aluminum Finishes" (AA Publication #45).
      i. The resulting anodized finish should be continuous, fully sealed and free of powdery surfaces, smut and blemishes.
   d. All fasteners shall be 316 stainless steel.
   e. Wall-mounted Handrail:
      i. 1-1/2" NPS Schedule 40 pipe.
      ii. Provide aluminum extruded handrail brackets, alloy 6063, anodized aluminum finish as specified above.
   f. Provide mitered and welded joints made by fitting post to top rail, intermediate rail to post, and corners, shall be groove welded and ground smooth.
      i. Splices, where allowed by the Engineer, shall be butted and reinforced by a tight fitting dowel or sleeve not less than 6-inches in length.
      ii. Tack weld or epoxy cement dowel or sleeve to one side of the splice.
   g. Provide 1/4" x 4" aluminum kick plate at each section of railing conforming to ASTM B209, alloy 6061, mill finish.
      i. Fasten to railing assembly with stainless steel fasteners.

C. Miscellaneous Steel Items. Armor angles, valve extension stem supports, bearing plates, pressure sensor mounting brackets, kick plates, lintel angles, platform edge channels, equipment supports for electric equipment, and other miscellaneous steel items shall be of structural steel conforming to ASTM Standard A36 and shall be of the shape, size and details indicated.
   1. All miscellaneous steel items shall be hot dipped galvanized.

D. Hot-Dipped Galvanized Metal Pan Stairs (Basement to Mezzanine Stairs):
   1. Provide steel stairs with complete stringers, metal-pan concrete-filled treads, grated steel treads, and necessary bolts and other fastenings.
      a. Steel stairs and accessories to be hot-dip-galvanized.
      b. Shop primer shall be TNEMEC Series 394 or approve equal.
   2. Design stairs to sustain a live load of not less than 100 pounds per square foot, or a concentrated load of 300 lbs. applied where it is most critical.
      a. Conform to AISC S335 or AISC AS342L with the design and fabrication of steel stairs, other than a commercial product.

b. Design fire stairs to conform to NFPA 101.

3. Materials:
   a. Provide hot-dipped galvanized steel stairs of welded construction except that bolts may be used where welding is not practicable.
      i. Screw or screw-type connections are not permitted.
   b. Structural Steel: ASTM A36/A36M.
   c. Support metal pan for grated steel treads or concrete fill on angle cleats welded to stringers or treads with integral cleats, welded to the stringer.
      i. Close exposed ends.
   d. Before fabrication, obtain necessary field measurements and verify drawing dimensions.
   e. Clean metal surfaces free from mill scale, flake rust and rust pitting prior to shop finishing.
      i. Weld permanent connections.
      ii. Finish welds flush and smooth on surfaces that will be exposed after installation.
   f. Risers and sub-treads shall be 12 gauge steel; sub-platform 10 gauge steel reinforced with angle stiffeners.
      i. Treads for concrete pan stairs shall be fabricated for granolithic fill as indicated on the Drawings.
   g. Railing shall be as specified in Paragraph 2.02.B, above.
      i. Fittings shall be provided at all railing posts for attachment to stair stringers.

E. Miscellaneous Aluminum Items: Support channels for electric boxes and other miscellaneous aluminum items shall be aluminum-alloy standard structural shapes conforming to ASTM Standard B308.

F. Safety Nosing for Concrete Stair Treads:
   1. Stair safety nosing: shall be as manufactured by Wooster Products Inc., Wooster, Ohio or an approved equal. Nosings shall be furnished by the Miscellaneous & Ornamental Iron Contractor and installed by the general contractor.
      a. Type 101SP Ferrogrit (Abrasive cast iron) for concrete filled steel pan stairs.
      b. Type 116 Ferrogrit (Abrasive cast iron) for cast-in-place concrete steps.
      c. Materials shall comply with Class 20 iron.
      d. High silicon.
      e. Three (3) inches in width.
      f. Cross-hatched surface.
      g. Concealed integral anchors.
      h. Full length of steps less 1/8-inch for metal pan steps.
      i. Four (4)-inches less than the full length of the step for cast-in-place concrete steps.

G. Aluminum Ships Ladder:
   1. Aluminum Ships Ladder and Components: Ladder, mounting brackets and handrails on both sides.
      a. Model: Model SL Aluminum Ships Ladder as manufactured by Precision Ladders, LLC.
      b. Capacity: Unit shall support a 500 lb (227 kg) total load without failure.
      c. Ladder Stringer: 5 inch by 2 inch by 3/16 inch (127 mm by 51 mm by 5

mm) extruded 6005-T5 aluminum channel. Pitch: 60 to 75 degrees.

d. Ladder Mounting Brackets:
   i. Floor Bracket: 2 inch by 3 inch by 1/4 inch (51 mm by 76 mm by 6 mm) aluminum angle.
   ii. Top Bracket: 4-3/4 inch by 5 inch by 1/4 inch (121 mm by 127 mm by 6 mm) aluminum angle.

e. Handrails: 1-1/4 inches (32 mm) Schedule 40, 6005-T5 aluminum pipe provided with internal aluminum fittings.

2. Fabrication
   a. Completely fabricate ladder ready for installation before shipment to the site.
   b. Completely fabricate handrail components ready for field assembly to ladder before shipment to site.

3. Provide mill finish on aluminum components.

H. Fixed Metal Bollards
1. Fabricate metal bollards from Schedule 40 steel pipe. Bollards surround the transformer shall be hot dipped galvanized in accordance with power company standards and as shown on the Drawings.
   a. Cap bollards with concrete fill, rounded for drainage.
2. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch-thick steel plate welded to bottom of sleeve.
   a. Make sleeves not less than 36 inches (200 mm) deep and 3/4-inch (19 mm) larger than OD of bollard.
3. Bollards and associated sleeves shall be installed by the General Contractor in accordance with the Contract Drawings and painted by the Painting Contractor in accordance with Section 09900.

I. Aluminum Awnings
1. Aluminum awnings shall be furnished and installed by the General Contractor and shall consist of the following:
   a. Frame shall be 1" x 1" square 6063-T6 aluminum tubing with a wall thickness of .0125"
   b. Standing seam metal cover shall be 1" standing seam, minimum 20-gauge (0.032 in.) aluminum with 70% PVDF resin-based finish.
   c. Final design and color shall be approved by the Owner and Engineer.

2. Shall be manufactured by Atlantic Awning, Melrose, MA or approved equal.

2.03 FRP GRATING PLATFORM AND STAIRS (GRATING PLATFORMS SPECIFICALLY ASSOCIATED WITH THE MIEX EQUIPMENT AND GREENSANDPLUS FILTERS TO BE DESIGNED AND PROVIDED BY GENERAL CONTRACTOR AS PART OF THE MIEX AND GREENSANDPLUS SYSTEMS)

A. FRP grating materials for MIEX and GreensandPlus filter platforms shall be as specified under Division 06, and shall be provided by the respective MIEX or GreensandPlus Filter Manufacturer as part of the work of the General Contractor.

2.04 FABRICATION

A. General:

1. Shop Assembly: Preassemble items in the shop to greatest extent possible.
    a. Disassemble units only as necessary for shipping and handling limitations.
    b. Use connections that maintain structural value of joined pieces.
    c. Clearly mark units for reassembly and coordinated installation.
2. Cut, drill, and punch metals cleanly and accurately.
    a. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated.
    b. Remove sharp or rough areas on exposed surfaces.
3. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
4. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
5. Weld corners and seams continuously to comply with the following:
    a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    a. Obtain fusion without undercut or overlap.
    b. Remove welding flux immediately.
    c. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
6. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
    a. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated.
    b. Locate joints where least conspicuous.
7. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water.
    a. Provide weep holes where water may accumulate.
8. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
9. Provide for anchorage of type indicated; coordinate with supporting structure.
    a. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
10. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

B. Railings:

1. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
2. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly.
    a. Disassemble units only as necessary for shipping and handling limitations.
    b. Clearly mark units for reassembly and coordinated installation.
    c. Use connections that maintain structural value of joined pieces.

3. Cut, drill, and punch metals cleanly and accurately.
   a. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated.
   b. Remove sharp or rough areas on exposed surfaces.
4. Form work true to line and level with accurate angles and surfaces.
5. Fabricate connections that will be exposed to weather in a manner to exclude water.
   a. Provide weep holes where water may accumulate.
6. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
7. Connections: Fabricate railings with welded connections.
   a. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose.
      i. Weld all around at connections, including at fittings.
   b. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   c. Obtain fusion without undercut or overlap.
   d. Remove flux immediately.
   e. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
8. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
9. Form changes in direction as follows:
   a. By bending or by inserting prefabricated elbow fittings.
   b. Form simple and compound curves by bending members in jigs to roduce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
10. Close exposed ends of railing members with prefabricated end fittings.
11. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
   a. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
12. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
13. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
   a. Fabricate anchorage devices capable of withstanding loads imposed by railings.
   b. Coordinate anchorage devices with supporting structure.
14. For railing posts set in concrete, provide plastic sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with steel plate forming bottom closure.
15. For removable railing posts, fabricate slip-fit sockets from stainless-steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.
   a. Provide socket covers designed and fabricated to resist being dislodged.

16. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated.
    a. Fabricate from same metal as railings.
17. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms.
    a. Fabricate to dimensions and details indicated.

C. Stairs:
1. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
    a. Join components by welding, unless otherwise indicated.
    b. Use connections that maintain structural value of joined pieces.
2. Preassembled Stairs: Assemble stairs in shop to greatest extent possible.
    a. Disassemble units only as necessary for shipping and handling limitations.
    b. Clearly mark units for reassembly and coordinated installation.
3. Cut, drill, and punch metals cleanly and accurately.
    a. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated.
    b. Remove sharp or rough areas on exposed surfaces.
4. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
5. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
6. Weld connections to comply with the following:
    a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    b. Obtain fusion without undercut or overlap.
    c. Remove welding flux immediately.
    d. Weld exposed corners and seams continuously, unless otherwise indicated.
    e. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
7. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
    a. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
    b. Locate joints where least conspicuous.
8. Fabricate joints that will be exposed to weather in a manner to exclude water.
    a. Provide weep holes where water may accumulate.

PART 3 EXECUTION

3.01 EXAMINATION

A. The Contractor shall verify all dimensions and take whatever field measurements as required to assure that all items function properly when installed.
1. Details of proposed departures due to field conditions or other causes shall be submitted to the Owner for review.

3.02 INSTALLATION

A. Anchors, bolts and inserts shall be installed as the Work progresses, as indicated on the Drawings, or where necessary to fasten miscellaneous metal items.

B. Railing shall be set with vertical members plumb, longitudinal members parallel, and all members in the same vertical plane.
   1. Posts shall be set in pipe sleeves and anchored as indicated, except for removable sections which shall not be anchored.

C. All sharp corners shall be field rounded and repaired as hereinbefore specified.

D. Fit exposed connections together to form tight, hairline joints.

E. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing handrails and railings.
   1. Set handrails and railings in location, alignment, and elevation, measured from established lines and levels and free from rack.
   2. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   3. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).

F. Corrosion Protection: Coat concealed surfaces of aluminum and copper alloys that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a coat of bituminous paint (minimum 10 mil thick).

G. Adjust handrails and railings before anchoring to ensure alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.

H. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

3.03 CLEANING

A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

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

3.04 PROTECTION

A. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer.
   1. Remove protective coverings at the time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work at no additional cost to the Owner.

1. Return items that cannot be refinished in field to shop; make alternations and refinish entire unit, or provide new units.

END OF SECTION

INDEX

DIVISION 6 WOOD AND PLASTICS

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials, tools, and equipment necessary to complete the work of this Section, including but not limited to the following:
   1. Wood blocking, cants, and nailers.
   2. Plywood backing panels.

B. Related Work: Documents affecting work of this Section include but are not necessarily limited to General Conditions, Supplementary Conditions and the Sections in Division 1 of these Specifications. The following items are not included in this Section and are specified under the designated Sections:
   1. Section 04200 – Unit Masonry
   2. Section 05500 – Metal Fabrications
   3. Section 06160 – Sheathing
   4. Section 06400 – Interior Architectural Woodwork for interior woodwork not specified in this Section.
   5. Section 08100 – Hollow Metal Doors and Frames
   6. Section 08302 – Fiberglass Doors and Frames
   7. Section 08520 – Aluminum Windows

1.02 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Testing Agency Qualifications: For testing agency providing classification marking for fire retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.03 SUBMITTALS

A. Comply with pertinent provisions of Section 01300.

B. Product Data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit information for each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D5516 and ASTM D5664.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
5. Include structural load calculations for prefabricated roof trusses as well as information on all materials, connections, and required materials for truss manufacturers.

1.04 DELIVERY, STORAGE, AND HANDLING

A. All materials and components shall be shipped, stored, handled, and installed in such a manner as to not degrade quality, serviceability, or appearance.

B. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.01 LUMBER

A. Lumber for general uses shall be sound, well-seasoned with moisture content suitable for intended use, square edged, free from shakes or other defects which would impair its strength and durability, and free from curves or warp which cannot be corrected in the process of erection.
1. All dimensions given are nominal and the actual dressed sizes shall conform to the established sizes for dressed lumber.

B. Grading: Lumber shall conform to the current grading rules and bear the official grade mark of the association under whose rules it is produced, or each shipment shall be accompanied by a Certificate of inspection issued by the association.
1. Lumber for plates, blocking, nailing strips and similar items shall be Construction Grade Dimension No. 2 Dense Southern Pine.
2. Strapping: Shall be 1" by 3" spruce or equal.
3. Framing Lumber shall be Douglas Fir, select structural as graded by the West Coast Lumber Inspection Bureau or Southern Pine, No. 2 Dense, or other lumber product having an allowable bending fiber stress of 1,250 psi and a modulus of elasticity of 1,400,000 psi. All other framing lumber not carrying calculated stresses shall be WCLB Stud Grade Douglas Fir, Southern Pine or better.

4. Plywood Sheathing: General: Sheathing shall conform to Product Standard, Structural I, Exposure 1 and be graded by the American Plywood Association.
5. Plywood Sheathing: Roof: 5/8" APA Structural I rated sheathing.

2.02 TREATED LUMBER

A. General:
1. All wood to be exposed to the weather, wood used for plates and nailers anchored to masonry and timber cribbing, and framing shall be pressure treated with Wolman salts.
2. Treating plant equipment, conditioning of timber, method of treatment and determination of retention and penetration of preservative shall be in accordance with American Wood Preservers Association Specification applicable to the class or kind of timber to be treated.

B. Quantity of Preservative:
1. Preservative shall conform with AWPA Spec. P5 and Federal Spec. TT-W-535C.
2. All timber shall be treated to leave injected in the wood not less than .35-pound Wolman Salts, dry salts basis, per cubic foot of wood.
3. Following treatment, lumber shall be air seasoned or kiln dried to a final moisture content as follows except that lumber intended for gluing shall be kiln dried only to a final moisture content of 16% maximum.
   a. Up to 2-inch nominal 12% to 15%
   b. 2-inch nominal & up to 3-inch nominal 15% to 18%
   c. 3-inch nominal 18% to 22%
   d. Lumber over 3-inch nominal size shall be dried only to remove excessive moisture. No definite final moisture is required.
4. Certificate: Treated lumber shall be accompanied by a certificate from a recognized lumber treating company certifying the amount of treatment and the percentage of moisture after drying.

2.03 INTERIOR WOOD TRIM

A. Wood trim shall be No. 2 Ponderosa Pine.

2.04 ROUGH HARDWARE

A. Steel Items:
1. Sheathing clips, truss ties, purlin hangers, column base anchors etc. shall be galvanized as manufactured by Simpson or an approved equal.
2. Lag Bolts: Square head type complying with Fed. Spec. FF-B-561.
3. Nails: Galvanized at all locations.
4. Machine Bolts; Comply with ASTM A307, Grade A and be hot-dipped galvanized.
5. Carriage Bolts: Comply with ANSI B18.5.

B. Concrete and Masonry Anchors: Where anchors are not included in the concrete or masonry construction, anchors shall be galvanized machine screws or bolts with standard expansion-shield type concrete anchors, Phillips "Red Head" Masonry Anchors as manufactured by Phillips Drill Co., or approved equal, of the sizes and types noted on Drawings or as required.

1. Do not use expansion bolts or anchors where other type anchors are shown on the Drawings.
2. Where required, finish work shall be anchored to concrete with Tapcon masonry anchors.

C. Powder activated fasteners shall not be used.

PART 3 EXECUTION

3.01 INSTALLATION:

A. General:
1. In addition to framing operations normal to the fabrication and erection indicated on the Drawings, install wood blocking and backing as required for the work.
2. Set horizontal and sloped members with crown up.
3. Do not notch, cut, or bore members for pipes, ducts or conduits or for other reasons except as shown on the Drawings or as specifically approved in advance by the Engineer.
4. When cutting or handling treated wood, comply explicitly with the manufacturer's handling precautions.
5. All of the sawdust, chips and waste pieces of the treated wood are to be collected in their entirety and properly disposed of.

B. Bearings:
1. Make bearings full unless otherwise indicated on the Drawings.
2. Finish bearing surfaces on which structural members are to rest so as to give sure and even support.
3. Where framing members slope, cut or notch the ends as required to provide a uniform bearing surface.

C. Blocking:
1. Install blocking as required to support soffit, items of finish, and to cut off concealed draft openings, both vertical and horizontal, between ceiling and floor areas.

D. Alignment:
1. On framing members to receive a finished surface, align the finish subsurface to vary not more than 1/8" from the plane of surfaces of adjacent furring and framing members.

3.02 INSTALLATION OF FINISH WORK

A. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacturer with respect to surfaces, sizes or patterns.

B. Install the work plumb, level, true and straight with no distortions.
1. Shim as required using concealed shims.
2. Install to a tolerance of 1/8" in 8'-0" for plumb and level countertops; and with 1/16" maximum offset in revealed adjoining surfaces.

3. Scribe and cut work to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

C. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum lengths of lumber available) to the greatest extent possible.
1. Stagger joints in adjacent and related members.
   a. Cope at returns, miter at corners, to produce tight fitting joints with full surface contact throughout length of joints.
   b. Use scarf joints for end-to-end joints.
2. Make exterior joints water-resistant by careful fitting.
3. Apply flat grain lumber with bark side exposed to weather.

D. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates.
1. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.
2. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailings, countersunk and filled flush with finished surface and matching final finish where transparent is indicated.

3.03 FASTENING

A. Nailing:
1. Use only common wire galvanized nails or spikes of the dimension required.
2. Provide penetration into the piece receiving the point of not less than one half the length of the nail or spike, provided, however, that 16d nails may be used to connect two pieces of two (2) inch (nominal) thickness.
3. Nail without splitting the wood.
4. Prebore as required.
5. Remove split members and replace with members complying with the specified requirements.

B. Bolting:
1. Drill holes 1/16” larger in diameter than the bolts being used.
2. Drill straight and true from one side only.
3. Do not bear bolt heads on wood (unless they are carriage bolts). Use washers under head and nut where both bear on wood, and use washers under all nuts.

C. Screws:
1. For lag screws and wood screws, prebore holes same diameter as root of threads, enlarging holes to shank diameter for length of shank.

D. Builders Hardware: Framing anchors, sheathing clips, rafter ty-downs, etc.
1. Position hardware accurately to ensure proper bearing and holding ability.
2. Attach to members in compliance with the manufacturer’s requirements.

3.04 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

A. Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace wood work.
1. Adjust joinery for uniform appearance.

B. Protection: Installer of finish carpentry work shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

END OF SECTION

SECTION 06160

SHEATHING

PART 1 GENERAL

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials, tools, and equipment necessary to complete the work of this Section, including but not limited to the following:
   1. Plywood sheathing attached to roof trusses.
   2. Plywood for blocking and substrates on the interior

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
   1. Section 04200 - UNIT MASONRY for masonry-veneer anchors and insulation in cavity wall construction.
   2. Section 06100 - ROUGH CARPENTRY for trusses.
   3. Section 07270 - AIR BARRIERS for modified water and air barrier over sheathing and membrane flashing.
   4. Section 07620 - SHEET METAL FLASHING AND TRIM for flashing applied to sheathing.

1.03 SUBMITTALS

A. Comply with pertinent provisions of Section 01300.

B. Product Data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit information for each product specified.

C. Evaluation Reports: For following products, from ICC-ES:
   1. Preservative-treated plywood
   2. Fire-retardant-treated plywood for interior blocking

1.04 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Source Limitations: Obtain each sheathing product through one source from a single manufacturer.

C. Fire-Resistance-Rated Assemblies: Where sheathing boards are part of fire-resistance-rated assemblies, provide assemblies as follows:
   1. Assemblies comply with requirements of fire-response-tested assemblies indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual"; or by design

designations in UL's "Fire Resistance Directory" or in certification listings of another testing and inspecting agency acceptable to authorities having jurisdiction.

2. Fire-resistance ratings were determined by fire-response testing assemblies according to ASTM E 119.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles, each bearing brand name and identification of manufacturer.

B. Store materials protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, or other causes.

1. Neatly stack plywood flat with spacers beneath and between each bundle to provide air circulation. Protect plywood from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.06 SEQUENCING AND SCHEDULING

A. Sequence installing sheathing with installing exterior cladding to comply with requirements indicated below:

1. Do not leave sheathing board exposed to weather for more than 90 days.

PART 2 PRODUCTS

2.01 PLYWOOD SHEATHING BOARD

A. Plywood: DOC PS 1 – 3/4" thickness for roof sheathing – provide panel spacing as required for roofing installation and to ensure warranty of roofing materials

B. Factory mark panels to indicate compliance with applicable standard.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

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

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. General: For all interior use materials, provide materials that are fire-retardant treated and comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber and ASTM D 5516, for plywood.
2. Use treatment that does not promote corrosion of metal fasteners.

2.04 FASTENERS

A. Screws for Fastening Sheathing to trusses: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
   1. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

B. Comply with applicable industry standard nailing specifications for structural and wind loading requirements.

PART 3 EXECUTION

3.01 INSTALLATION OF PLYWOOD SHEATHING

A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.

E. Countersink fastener heads on exposed carpentry work and fill holes with wood filler.

F. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

END OF SECTION

SECTION 06400

INTERIOR ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials, tools, and equipment necessary to complete the work of this Section including, but not limited to, the following:
   1. Opaque finished wood window stools.
   2. Plastic-laminate casework.
   3. Plastic-laminate countertops.

B. Related Work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and the Sections in Division 1 of these Specifications. The following items are not included in this Section and are specified under the designated Sections:
   1. Section 06100 – Rough Carpentry for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

1.02 SUBMITTALS

A. Comply with pertinent provisions of Section 01300.

B. Product Data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit information for each type of product specified, including casework hardware and accessories, and finishing materials and processes.
   1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   2. Show locations and sizes of cutouts and holes for plumbing fixtures, electrical components and other items installed in architectural woodwork.
   3. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

D. Samples for Verification:
   1. Lumber with or for transparent finish, not less than 5 inches wide by 12 inches long for each species and cut, finished on 1 side and 1 edge.
   2. Veneer leaves representative of and selected from flitches to be used for transparent finished woodwork.
   3. Lumber and panel products with shop-applied opaque finish, 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color, with 1/2 of exposed surface finished.

4. Plastic laminates, 8 by 10 inches for each type, color, pattern, and surface finish, with 1 sample applied to core material, and specified edge material applied to 1 edge.
5. Solid-surfacing materials, 6 inches square.

E. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

F. Qualification Data: For Installer and fabricator.

1.03 QUALITY ASSURANCE

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

B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers.

D. Quality Standard: Unless otherwise indicated, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
1. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.

E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 and review methods and procedures related to architectural woodwork construction.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other

than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Section 1.05 of this Specification.

1.05 PROJECT CONDITIONS

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

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

1.06 COORDINATION

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

PART 2 PRODUCTS

2.01 INTERIOR ARCHITECTURAL WOODWORK MATERIALS

A. General: Provide materials that comply with requirements of AWI/AWMAC/WI's "Architectural Woodwork Standards" for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Veneers and Lumber: Provide AWI Premium Grade materials and workmanship.
   1. Provide AWI Lumber Grade 1 and AWI Grade A Veneer, book-matched, minimum 6 inch face veneer width. Kiln dry to 6-8 percent moisture content. Components shall be free of defects and sapwood. Match adjacent pieces for color and grain pattern.
   2. Single-Source Requirement for Wood Veneers and Solids: Intent is to provide wood which matches as closely as possible throughout the project. Provide wood veneers and solids from the same distributor, and from the same flitches and solids sources to the greatest extent possible.

C. Wood Species and Cut for Transparent Finish: Select White Maple and Cherry to match Engineer’s sample; at locations selected by Engineer.

D. Wood Species for Opaque Finish: Any closed-grain hardwood.

E. Wood Products: Comply with the following:
   1. Hardboard: AHA A135.4.
   2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no added urea formaldehyde.
   3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
   4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
   5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no added urea formaldehyde.

F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:
      a. Abet Laminati, Inc.
      b. Formica Corporation.
      c. Lamin-Art, Inc.
      d. Nevamar Company, LLC; Decorative Products Div.
      e. Wilsonart International; Div. of Premark International, Inc.

G. Solid-Surfacing Material (Resinous): Homogeneous solid sheets of filled plastic resin complying with ANSI SS-1 and ISSFA-2.
   1. 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:
      a. E. I. du Pont de Nemours and Company; Corian.

2.02 CASEWORK HARDWARE AND ACCESSORIES

A. General: Provide casework hardware and accessory materials associated with architectural casework, except for items specified in Section 08710 - Finish Hardware.
   1. Provide the following hardware as manufactured by Knape and Vogt or approved equal:
      a. Typical Wire Pulls.
      b. Heavy duty self-closing drawer slides.
      c. Heavy duty standards and brackets adjustable.
      d. Concealed hinges.
      e. Door silencers.
      f. Metal shelf supports for adjustable cabinet shelves.
      g. Catches: Push-in magnetic catches, BHMA A156.9, B03131.

B. Grommets for Cable Passage through Countertops: Molded-plastic grommets and matching plastic caps with slot for wire passage.

C. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Stainless Steel: BHMA 630.
   2. Satin Aluminum, Clear Anodized: BHMA 628.

2.03 INTERIOR WINDOW STOOLS FOR OPAQUE FINISH

A. Grade: Custom.

B. Wood Species: Any closed-grain hardwood.

C. Back out or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

D. Assemble casings in plant except where limitations of access to place of installation require field assembly.

2.04 PLASTIC-LAMINATE CASEWORK

A. Grade: Custom.

B. AWI Type of Casework Construction: Flush overlay.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Post formed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.
4. Edges: Grade HGS.

D. Materials for Semi exposed Surfaces:
1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
   a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
   b. For semi exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
2. Drawer Sides and Backs: Solid-hardwood lumber.
3. Drawer Bottoms: Hardwood plywood.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As selected by Owner from laminate manufacturer's full range.

2.05 PLASTIC-LAMINATE COUNTERTOPS

A. Grade: Custom.

B. High-Pressure Decorative Laminate Grade: HGS.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As selected by Owner from manufacturer's full range.

D. Edge Treatment: As indicated.

E. Core Material: Exterior-grade plywood.

F. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.06 SHOP FINISHING

A. General: Comply with AWI/AWMAC/WI's "Architectural Woodwork Standards" for factory finishing.
   1. Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
   1. Back priming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require back priming when surfaced with plastic laminate, backing paper, or thermoset decorative panels. Contractor shall coordinate the primer with the Painting Contractor to ensure the primer is compatible with the intermediate and finish coat painting products being provided by the Painting Contractor under Section 09900 – Painting.

C. Shop Priming: Shop apply the prime coat including back priming, if any, for opaque-finished items specified to be field finished. Intermediate and top coat painting systems shall be provided by the Painting Contractor under Section 09900 – Painting.

D. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen with sheen measured on 60-degree gloss meter per ASTM D 523:
   1. Grade: Same as item to be finished.
   2. AWS Finish System 5: Conversion varnish.
   3. Staining: Match approved sample for color.
   4. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed grain wood before staining and finishing.
   5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
   6. Sheen: Satin, 30-50 gloss units.

E. Opaque Finish: Comply with requirements indicated below for grade, finish system, color, effect, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523.
   1. Grade: Same as item to be finished.
   2. AWS Finish System 5: Conversion varnish.
   3. Color: As selected by Owner from manufacturer's full range.
   4. Sheen: Satin, 30-50 gloss units.

PART 3 EXECUTION

3.01 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

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

3.02 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
   1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
   2. Install standing and running trim with no more variation from a straight line than 1/8-inch in 96 inches.

G. Casework: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   1. Install casework with no more than 1/8-inch in 96-inch sag, bow, or other variation from a straight line.

H. Countertops: Anchor securely by screwing through corner blocks of base casework or other supports into underside of countertop.
   1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

2. Install countertops with no more than 1/8-inch in 96-inch sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches and to walls with adhesive.
4. Caulk space between backsplash and wall with sealant specified in Section 07920 - Joint Sealants. Caulking shall be provided by the Waterproofing, Dampproofing and Caulking Contractor under Section 07920.

I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 06610

FIBERGLASS FABRICATIONS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Included: Provide fiberglass guards, ladders, and grating, stairway railings, and hand rails as required by the Contract Documents.
   1. In general the work of this Section includes all labor, equipment, tools, materials and appurtenances necessary for the complete fabrication and installation of fiberglass guards, ladders, grating, stairway, railings, and hand rails.

B. The Contractor shall furnish a design by a Massachusetts Registered Professional Engineer for all stairs and elevated platform components.

1.02 RELATED WORK

A. Documents affecting work of this Section include but are not necessarily limited to General Conditions, Supplementary Conditions and the Sections in Division 1 of these Specifications.
   1. Section 03300 Cast-In-Place Concrete.
   2. Section 06100 Carpentry Work

1.03 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.04 SUBMITTALS

A. Comply with pertinent provisions of Section 01300.

B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
   1. Materials list of items proposed to be provided under this Section.
   2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
   3. Shop Drawings in sufficient detail to show the required anchorage, connections, and interface of the work of this Section with the work of adjacent trades.

1.05 PRODUCT HANDLING

A. All materials and components shall be shipped, stored, handled, and installed in such a manner as to not degrade quality, serviceability, or appearance.

1.06 DESIGN CRITERIA

A. The materials and items covered by this Specification are intended to be standard materials and items of proven ability as manufactured by reputable concerns.
   1. Materials and items shall be designed and constructed in accordance with the best practice of the industry, and shall be installed in accordance with the manufacturer's recommendations and the Contract Documents.

B. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials and items.

PART 2 PRODUCTS

2.01 FIBERGLASS STAIRWAYS AND PLATFORM GRATING

A. Stairways and Platforms
   1. Stair stringers and framing shall be fabricated from 10-inch pultruded fiberglass channels.
      a. Resin: ISOFR
      b. Stair treads shall be 1-1/2-inches thick by 11-inches deep fabricated from pultruded fiberglass with nosing.
      c. Resin: ISOFR
   2. Connections shall be made with 316 stainless steel machine bolts, nuts and washers.
   3. All anchors into masonry shall be made with 316 stainless steel inserts and bolts.
   4. Shall comply with pertinent requirements.
   5. Size as shown on the Drawings and as required by the design manufacturer.

B. Grating shall be Duradek Pultruded "I" Bar Grating as manufactured by Strongwell, Chatfield, MN or an approved equal.

1.	Series:	I-6000
2.	Panel thickness:	1 1/2-inch
3.	Bearing bar spacing:	1 1/2-inches on center
4.	Bar type:	"I"
5.	Open Area:	60 percent
6.	Flame spread index	25 or below
7.	Grating color	yellow
8.	Yellow Safegrit wearing surface	
9.	316 S.S. hold-down clips	
10.	UV inhibitors	

   11. Deflection at a 48-inch span shall not exceed 0.108 inches with a 200 lb. concentrated live load.

2.02 FIBERGLASS LADDERS

A. Access Ladders
   1. All Ladder and cage components shal be flame retardant per ASTM E-84 Class.
   2. Ladder rails shall be 2 inch by 2 inch by ¼ inch square tubes, manufactured by the pultrusion process.
   3. Ladder rungs shall be 1 inch dimater solid round with non-slip grit surface.

4. Ladder shall be fastened to the wall and floor with 316 stainless steel inserts and bolts.
5. Shall Compaly with pertinent OSHA requirements.

2.03 FIBERGLASS GUARDS/RAILINGS

A. Guards/Railings shall comply with OSHA pp. 1910.23 entitled "Guarding Floor and Wall Openings" and shall be able to withstand a 1000 pound concentrated load (vertical or horizontal) at any point on the top rail. Maximum permitted deflectionunder a 200 pound concentrated vertical load shall be 3/16-inch.
1. Posts shall be a minimum of 2-inch by 2-inch by 3/8-inch square tube, connected to concrete wall with stainless steel inserts.
2. Color shall be safety yellow
3. Joints shall be bonded and mechanically fastened using non-metalic hardware.
4. Toeplates shall be channel shaped to provide both horizontal and vertical stifness without sag, and shall run true with the guard.
5. Top rails shall be continuous wherever possible and a single unspliced length shall be attached to a minimum of three posts.

B. Post spacing shall be a maximum of 4-feet on center, measured along the rail.
1. Posts are not to be located at the corner of the guard. Rather, use a post on each side of the corner, up to a maximum of 2-feet away from it.

C. Unless otherwise noted, top rail on platforms and other level runs shall be 42-inches from top of rail to floor.
1. Stairway railing shall be 36-inches from edge of tread to top of rail.
2. Intermediate rails shall be evenly located.

2.04 FIBERGLASS GRATING (SUMPS)

A. Grating shall be Corgrate FRP Grating as manufactured by IKG Industries, Nashville, TN or an approved equal.
1. System Type: 1-1/2 inch FW40PF
2. Panel thickness: 1-1/2 inches
3. Bearing bar spacing: 1 inch on center
4. Bar type: I
5. Crossbars spaced at: 6 inches
6. Flame spread index: 15 or below
7. Yellow Safegrit wearing surface.
8. Hold-down clips shall be provided.
9. UV inhibitors.
10. Deflection at a 36-inch span shall not exceed 0.160 inches with a 500 lb. uniform load.

2.05 GRATING SEAT

A. Where required provide 1-1/2" by 2" by 1/4" FRP angle with anchors 18 inches on center.
1. Anchors shall be 5 inches long by 1-3/8 inches wide.
2. Anchors shall be securely bonded to the FRP angle.

PART 3 EXECUTION

3.01 GENERAL

A. All items specified herein shall be installed in accordance with the manufacturer's instructions and as shown on the Drawings.
   1. Touch up or seal any damaged surfaces or edges of fiberglass items before installation.
   2. All fasteners shall be stainless steel.

3.02 GRATING INSTALLATION

A. No grating shall be installed until the project is ready for acceptance and the Engineer has given his acceptance.
   1. Contractor shall span openings with fabricated plywood panels properly braced and anchored in place until the grating is installed.

B. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.
   1. Check measurements of grating to determine fit.
   2. Perform all work in accordance with the Drawings and the approved submittals.
   3. All field cuts or sanded surfaces shall be coated with resin furnished by the manufacturer and applied in accordance with manufacturer's instructions.
   4. Each piece of grating shall have a minimum of four hold down clips.

C. Supporting members shall be fiberglass of the size and shape indicated.
   1. Gratings, supports and all other necessary accessories shall be installed under this Section.
   2. Grating seats to be installed prior to concrete placement.
   3. When span of grating changes direction, such as at channel intersections, provide suitable supporting members, as required.

3.03 FIBERGLASS LADDER INSTALLATION

A. Fiberglass ladders shall be furnished and installed as shown on the Contract Drawings.

B. The Contractor shall furnish and install on the top section of each ladder, a Bilco "Pogo-Pole" Portable Safety Post, as manufactured by The Bilco Company or approved equal. The receiver section shall be fabricated of stainless steel and be attached to the ladders using stainless steel hardware. The safety post section shall be manufactured from steel and be hot dip galvanized after fabrication. The post section shall be removable.

3.04 FIBERGLASS RAILING INSTALLATION

A. Fiberglass railings shall be furnished and installed on each intermediate access platform as shown on the Contract Drawings.

B. The Contractor shall install the handrail system in strict accordance with the manufacturer's instructions.

3.05 FIBERGLASS GRATING INSTALLATION

A. Fiberglass gratings shall be furnished and installed on each intermediate access platform as shown on the Contract Drawings.

B. Gratings shall bear on the fiberglass framing. Minimum of four fasteners per grating section shall be used to attach the grating to the framing.

3.06 CLEANUP

A. At the completion of the work all labels shall be removed and the units shall be cleaned and left free of blemishes.
   1. Fabrications shall be given a cleaning with water and a mild detergent.
   2. All erection and fabrication markings shall be removed.

END OF SECTION

INDEX

DIVISION 7 THERMAL AND MOISTURE PROTECTION

SECTION 07101

WATERPROOFING, DAMPPROOFING AND CAULKING FILED SUB-BIDS

PART 1 GENERAL

1.01 WATERPROOFING, DAMPPROOFING AND CAULKING FILED SUB-BID

A. The work of the following sections requires a filed sub-bid in accordance with M.G.L. C.149, S.44A through 44J, inclusive, as amended. These sections will be covered under a single filed sub-bid for the Waterproofing, Dampproofing and Caulking category of work.
   1. Section 07170 Bentonite Membrane Waterproofing
   2. Section 07270 Air and Water Barriers
   3. Section 07920 Joint Sealants

B. Reference Drawings: The work of this Section is shown on the following Drawings:
   1. 01-A-1 through 01-A-3, 20-A-1 through 20-A-18, 99-A-1 through 99-A-3
   2. 01-S-01, 20-S-1 through 20-S-30
   3. 20-D-1 through 20-D-16, 99-D-1 through 99-D-4
   4. 20-P-1 through 20-P-2, 99-P-1 through 99-P-2
   5. 01-FP-1, 20-FP-1 through 20-FP-4

C. Requirements of Submitting Sub-bids:
   1. Sub-bids for work under this Section shall comply with the requirements of M.G.L. C.149, S.44D and 44F; shall be filed in a form furnished by the Awarding Authority, in a sealed envelope, at the time and place stipulated in the Advertisement for Bids and Information for Bidders; and shall be accompanied by a Bid Deposit in the amount of five percent of the sub-bid price complying with the requirements of M.G.L. C.149, S.44B (2). The following should appear on the upper left-hand corner of the envelope:

      SUB-BIDDER: Contractor Name

      SUB-BID FOR: Waterproofing, Dampproofing and Caulking

      PROJECT: Wading River Water Treatment Plant
      Contract No. 10, DWSRF No. 16764

D. SUB-SUBLISTINGS

   1. Sub-sub trades are categories of work within a filed sub-bid trade and are indicated in Paragraph E on the Form for Sub-bid. If sub-sub trades are requested and identified follow the instructions below. The proposed contract price submitted by the filed sub-bidder on the Form for Sub-Bid includes the cost of any sub-sub trades**.**

      a. Sub-sub bids are required for the following subcategories of this section:

Class of Work	Reference Paragraph

2. Sub-bidders shall include the appropriate information for the above listed sub-categories in Paragraph E of the Form for Sub-bid.

3. If the filed sub-bidder customarily performs the above work with its own workforce the sub-bidder should list its own name and trade, and leave the dollar amount blank.

4. If the filed sub-bidder does not customarily perform the above work with its own workforce the sub-bidder should list the name of the contractor performing the work, the trade and insert a dollar amount.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 07170

BENTONITE MEMBRANE WATERPROOFING

PART 1 GENERAL

1.01 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. List of materials proposed for use.
      b. Specifications for materials proposed for use.

B. Informational Submittals:
   1. Manufacturer's instructions and details for installation of membrane.
   2. Sample copy of warranty.
   3. Manufacturer's approval of Applicator.
   4. Manufacturer's Certificate of Proper Installation.
   5. Special guarantee.

1.02 QUALITY ASSURANCE

A. Applicator's Qualifications: Minimum of 3 years' experience in the installation of the waterproofing products specified.
   1. Application Workers: Trained and approved by the manufacturer.

B. Preinstallation Meeting: Prior to start of installation of the Work specified herein, participate in a site meeting attended by Contractor, Applicator, field supervisor, materials supplier, and Engineer.
   1. Agenda: Review areas scheduled to receive bentonite waterproofing system and reach agreement on installation procedures to be used.

1.03 SPECIAL GUARANTEE

A. Manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of the Owner, removal and replacement of Work specified in this Specification section found defective during a period of 5 years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in General Conditions.

PART 2 PRODUCTS

2.01. MANUFACTURERS AND PRODUCTS

A. American Colloid Co., CETCO; Volclay Products.

B. Carlisle; Miraclay.

C. Tremco; Paraseal.

2.02. BENTONITE WATERPROOFING MEMBRANE

A. Bentonite membrane for use on buried vertical and horizontal conditions such as backfilled foundation walls and below slabs:

1.	Puncture resistance	169 lbs.	ASTM E154
2.	Tensile strength	4,000 psi	ASTM D412
3.	Water vapor permeance	0.03 perms	ASTM E96
4.	Percent elongation	700 percent	ASTM D638, Type 4 Dumbbell
5.	Resistance to hydrostatic head	150 feet	ASTM D751

2.03 ACCESSORIES

A. Manufacturer's standard accessories, including protection board, sealants, seam tapes, fasteners, mastic, flashing, etc. shall be provided.

PART 3 EXECUTION

3.01 PREPARATION

A. General:
1. Examine substrate and conditions under which work is to be performed. Condition of substrate and working conditions shall meet membrane manufacturer's specific recommendations.
2. Applicator shall notify Contractor in writing if unsatisfactory conditions exist.
3. Do not begin Work until unsatisfactory conditions are corrected.
4. Application of membrane signifies that applicator accepts condition of substrate.
5. Protect surface with installed bentonite from rain and other moisture conditions if imminent.

B. Hydrostatic Conditions: When encountered, consult manufacturer for specific recommendations.

C. Expansion Joints: Install membrane as recommended by manufacturer when called for over expansion joints.

3.02 APPLICATION

A. Install bentonite membrane following manufacturer's printed instructions.

3.03 MANUFACTURERS' SERVICES

A. Provide manufacturer's representative at Site in accordance with Section 01445 – Manufacturer's Services, for installation assistance, inspection, and certification of proper installation.

3.04 INSTALLATION

A. Install bentonite membrane below the entire floor slab of the Water Treatment Plant and up along foundation and tank walls in accordance with the Contract Drawings (including above grade where shown) to fully waterproof the exterior concrete slabs and walls of the below grade structure. Exterior bentonite membrane waterproofing shall be applied to the following locations, as well as any other locations specifically identified on the Contract Drawings:
   1. Water Treatment Plant and Pipe Gallery.
   2. Intermediate Wetwell.
   3. Clearwell.
   4. Backwash Supply Tank.
   5. Spent Backwash Tank.
   6. Slabs on Grade.

B. All penetrations through the membrane shall be sealed according to the manufacturer's recommendations.

END OF SECTION

SECTION 07201

ROOFING AND FLASHING FILED SUB-BIDS

PART 1 GENERAL

1.01 ROOFING AND FLASHING FILED SUB-BID

A. The work of the following sections requires a filed sub-bid in accordance with M.G.L. C.149, S.44A through 44J, inclusive, as amended. These sections will be covered under a single filed sub-bid for the Roofing and Flashing category of work.
   1. Section 07500 Membrane Roofing
   2. Section 07620 Metal Flashing and Trim
   3. Section 07720 Roof Specialties and Accessories

B. Reference Drawings: The work of this Section is shown on the following Drawings:
   1. 01-A-1 through 01-A-3, 20-A-1 through 20-A-18, 99-A-1 through 99-A-3
   2. 01-S-01, 20-S-6, 20-S-20

C. Requirements of Submitting Sub-bids:
   1. Sub-bids for work under this Section shall comply with the requirements of M.G.L. C.149, S.44D and 44F; shall be filed in a form furnished by the Awarding Authority, in a sealed envelope, at the time and place stipulated in the Advertisement for Bids and Information for Bidders; and shall be accompanied by a Bid Deposit in the amount of five percent of the sub-bid price complying with the requirements of M.G.L. C.149, S.44B (2). The following should appear on the upper left-hand corner of the envelope:

      SUB-BIDDER: Contractor Name

      SUB-BID FOR: Roofing and Flashing

      PROJECT: Wading River Water Treatment Plant
      Contract No. 10, DWSRF No. 16764

D. SUB-SUBLISTINGS

   1. Sub-sub trades are categories of work within a filed sub-bid trade and are indicated in Paragraph E on the Form for Sub-bid. If sub-sub trades are requested and identified follow the instructions below. The proposed contract price submitted by the filed sub-bidder on the Form for Sub-Bid includes the cost of any sub-sub trades**.**

      a. Sub-sub bids are required for the following subcategories of this section:

      Class of Work Reference Paragraph

   2. Sub-bidders shall include the appropriate information for the above listed sub-categories in Paragraph E of the Form for Sub-bid.

3. If the filed sub-bidder customarily performs the above work with its own workforce the sub-bidder should list its own name and trade, and leave the dollar amount blank.

4. If the filed sub-bidder does not customarily perform the above work with its own workforce the sub-bidder should list the name of the contractor performing the work, the trade and insert a dollar amount.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 07217

BELOW GRADE PERIMETER INSULATION

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: Provide below grade perimeter insulation on all new building construction as required by the Contract Documents.
   1. In General: For areas with floor slabs on grade, perimeter insulation shall be installed along the interior of the foundation walls and beneath the perimeter of the floor slab of the building.
   2. For areas with basements or storage tanks located beneath the facility, perimeter insulation shall be installed along the exterior of the foundation, with the top of the insulation being at finish grade and extending downward to the foundation footings or base slab.
   3. At foundation areas exposed above grade, hold typical perimeter insulation approximately 6" below grade, and provide specified exposed perimeter concrete faced insulation from top of typical perimeter insulation to slab level.

1.02 RELATED WORK

A. Documents affecting work of this Section include but are not necessarily limited to General Conditions, Supplementary Conditions and the Sections in Division 1 of these specifications
   1. Section 02200 Earthwork
   2. Section 03300 Cast-In-Place Concrete
   3. Section 07100 Waterproofing and Damp-Proofing

1.03 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.04 CODES AND STANDARDS

A. Massachusetts State Building Code:
   1. 780 CMR: State Board of Building Regulations and Standards:
      a. Building Insulation Specifications.

B. ASTM Standards:
   1. C578: Specifications for Preformed, Cellular Polystyrene Thermal Insulation.
   2. C578: Water absorption, max. 0.3% by volume.
   3. D1621: Test for Compressive Properties of Rigid Cellular Plastics.
   4. C518: Test for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter

1.05 SUBMITTALS

A. Comply with pertinent provisions of Section 01300.

B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
   1. Materials list of items proposed to be provided under this Section.
   2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
   3. Manufacturer's recommended installation procedures which, when approved by the Engineer, shall become the basis for accepting or rejecting actual installation procedures used on the Work.
   4. Manufacturer's thermal performance warranty.

1.06 PRODUCT HANDLING

A. Comply with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Below Grade Perimeter Insulation: Provide the following below grade perimeter insulation as specified herein.
   1. Shall be closed cell, rigid, square edge Styrofoam Brand, as manufactured by Dow Chemical Company or an approved equal.
   2. Shall meet ASTM C578, Type IV.
   3. Thickness shall be two (2) inches, unless shown to be thicker on the Contract Drawings where required.
   4. C-Factor (1/U-value) shall not be less than 0.10 at a mean temperature of 75 degrees F.

B. Exposed Perimeter Foundation Insulation (above grade conditions only, see 1.01.A.3 for intent of scope): Provide the following perimeter insulation at foundation wall where exposed above grade:
   1. Extruded polystyrene board insulation with factory applied 5/16-inch latex modified concrete facing.
   2. Manufacturer and Product: T-Clear Corporation; WallGUARD, or approved equal.
   3. Thickness shall be two (2) inches.
   4. C-Factor (1/U-Value) shall not be less than 0.10 at a mean temperature of 75 degrees F.
   5. Acrylic Coating Manufacturer and Product: Weatherall Company Inc.; Palladium Textures Coating or approved equal, color shall be selected by the Owner. Apply the acrylic coating on facing in areas where the perimeter insulation is exposed above grade.

C. Adhesive:
   1. Shall be as recommended by the insulation manufacturer.

D. Vapor Barrier: Proide the following under any floor slabs that are on grade.
   1. Six (6) mill polyethylene film.

2.02 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor, subject to the approval of the Engineer.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed.
   1. Correct conditions detrimental to timely and proper completion of the Work.
   2. Do not proceed until unsatisfactory conditions are corrected.

B. Foundation wall substrate shall be flat and free of fins and irregularities and other materials that may impede adhesive bond.

3.02 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.03 INSTALLATION

A. Vapor Barrier: Floor slab grade shall be compacted, drained and covered with the specified vapor barrier.
   1. All seams shall be taped.
   2. All damaged sections shall be repaired and sealed.

B. Insulation: Install insulation in strict accordance with the manufacturer's printed installation procedures.
   1. Attach to the exterior of walls with the recommended adhesive, carefully following the adhesive manufacturer's installation instructions.
   2. Shall be placed from the top of the footing or base slab, to 6-inches below finish grade except where noted otherwise in the Contract Documents, and run continuously around the perimeter of the foundation walls.
   3. Cut insulation to fit snugly around pilasters, projections, curves and irregularities on the wall surface.
      a. Fill all voids with insulation.

END OF SECTION

SECTION 07270

AIR AND WATER BARRIERS

(PART OF WORK OF SECTION 07101 – WATERPROOFING, DAMPPROOFING AND CAULKING FILED SUB-BIDS, Filed Sub-Bid Required)

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work of this Section includes all labor, materials, tools, staging, and equipment necessary to complete the air and vapor barrier on the building masonry walls as required by the Contract Documents. Work includes, but is not limited to, the following:
   1. Fluid applied air and vapor barrier.
   2. Flashings.
   3. Flashing Primer.
   4. Sealant.
   5. Thru-Wall Flashing.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
   1. Section 04200 – Unit Masonry for providing the masonry on which the fluid applied air and vapor barrier shall be furnished and installed.
   2. Section 07500 – Membrane Roofing includes the vapor retarder which shall be furnished and installed by the Roofing and Flashing Contractor.

1.02 DEFINITIONS

A. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall or soffit, including joints and junctions to abutting construction, to control air movement through the wall.

1.03 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

1.04 PRECONSTRUCTION TESTING

A. Mockup Testing: Air barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
   1. The Contractor shall engage a qualified testing agency.
   2. Quantitative Air Leakage Testing: Testing of the mockup for air leakage will be conducted not to exceed the test pressure differential, positive and negative, indicated in "Performance Requirements" Article for air barrier assembly air leakage when tested according to ASTM E783.

3. Notify Engineer and the Owner a minimum of seven days in advance of the dates and times when mockup testing will take place.

1.05 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; manufacturer's details; and tested physical and performance properties of air barrier.

B. Shop Drawings and submittals shall be provided in accordance with Section 01300 within 30 calendar days after the Contractor has received the Owner's Notice to Proceed for the air and vapor barrier system. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   1. Include details of interfaces with other materials that form part of air barrier.
   2. Include details of mockups.

C. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with project materials that connect to or that come in contact with air barrier; signed and warranted by a single product manufacturer.

D. Air Barrier Certification: Submit manufacturer's certification that air barrier, as designed in the assemblies indicated on the Drawings, has been tested to meet the requirements of NFPA 285 and passed.

E. Qualification Data: Applicator shall submit certificate from the manufacturer certifying the applicator is qualified to install the air and vapor barrier system.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this project, whose work has resulted in applications with a record of successful in-service performance. Proper applicator certifications shall be submitted prior to construction as required herein.

B. Mockups: Before beginning installation of air barrier, coordinate and apply the air and vapor barrier to mockups of exterior wall assembly approximately 150 sq. ft. in area and constructed by the General Contractor or Masonry Contractor to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
   1. Coordinate construction of mockup to permit inspection by testing agency of air barrier before external insulation and cladding is installed.
   2. Include junction with roofing vapor retarder, building corner condition, and foundation wall intersection.
   3. If the Engineer determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

C. Pre-installation Conference: Conduct conference at Project site.
   1. Include installers of other construction connecting to air barrier, such as roofing, waterproofing, masonry, joint sealants, windows, glazed curtain walls, and door frames.
   2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.

B. Remove and replace liquid materials that cannot be applied within their stated shelf life.

C. Store rolls according to manufacturer's written instructions.

D. Protect stored materials from direct sunlight.

E. Keep solvents away from open flames or excessive heat.

F. Storage and handling of materials shall be in accordance with Safety Data Sheets from the manufacturer.

1.08 PROJECT CONDITIONS

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

1.09 WARRANTY

A. Provide manufacturer’s standard ten (10) year material warranty on the air and vapor barrier system from the date of Substantial Completion.

PART 2 PRODUCTS

2.01 FLUID APPLIED AIR AND VAPOR BARRIER MANUFACTURER

A. Manufacturers and Products: Subject to compliance with requirements, manufacturers and products include, but are not limited to, the following:
   1. Tremco Sealants, ExoAir 120 SP.
   2. Henry Company, Air-Bloc 16 MR.
   3. GCP Applied Technologies, Perm-A-Barrier NPL 10

2.03 FLUID APPLIED AIR AND VAPOR BARRIER

A. Single-component, water-based, water-resistive air barrier designed to provide a vapor impermeable air and water barrier when applied on above-grade wall assemblies, having the following typical properties:
   1. Basis of Design: Air-Bloc 16 MR Fluid Applied Air and Vapor Barrier.
   2. Color: Gray
   3. Solids Content:
      a. Weight: 69%
      b. Volume: 60%
   4. Minimum Application Temperature: +20 °F
   5. Service Temperature: -40 °F to +180 °F
   6. Water Vapor Permeance (ASTM E96):
      a. Method A: 0.03 perms
   7. Air Permeance:
      a. Material (ASTM E2178): 0.0013 L/s.m.2
      b. Air Leakage – Assembly (ASTM E2357): Pass
   8. Elongation (ASTM D412): 270%
   9. Tensile Strength (ASTM D412): 100 psi
   10. Nail Sealability (AAMA 711/ASTM D1970 modified): Pass
   11. Water Absorption (ASTM D570): 4.6%
   12. Surface Burning Characteristics (ASTM E84):
      a. Flame Spread Index: 20, Class A
      b. Smoke developed: 85, Class A
   13. Fire Testing (NFPA 285): Complies in various assemblies
   14. VOC Content, max (EPA Method 24): ≤50 g/L Method 24
   15. Declaration Status: LBC Red List Free

2.02 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Flashings: Select from the following:
   1. Liquid-applied flashing:
      a. Moisture-cure one component elastomeric liquid applied flashing using an STPE (Silyl-Terminated Polyether) polymer. Basis of design shall be Henry Air-Bloc LF Liquid Applied Flashing.
   2. Self-adhered flashing:
      a. Vapor impermeable, self-adhered water resistive air and vapor barrier consisting of an SBS rubberized asphalt compound, integrally laminated to a blue engineered thermoplastic film. Basis of design shall be Henry Blueskin® SA Self-Adhered Water Resistive Air Barrier.

C. Adhesives/Primers for Self-Adhered Flashing:
   1. Low VOC:
      a. Synthetic rubber based quick setting adhesive with low VOC content, max (EPA Method 24): 240 g/L. Basis of design shall be Henry® Blueskin® LVC Adhesive.

b. Polymer emulsion-based primer for self-adhered membranes with low VOC content, max (EPA Method 24): 50 g/L. Basis of design shall be Henry Aquatac™ Primer.

D. Sealants:
1. Moisture cure, medium modulus polymer modified sealing compound, having the following typical properties:
a. Basis of Design: Henry 925 BES Sealant.
b. Complies with Fed. Spec. TT-S-00230C, Type II, Class A.
c. Complies with ASTM C920, Type S, Grade NS, Class 35.

E. Thru-Wall Flashing:
1. Vapor impermeable, self-adhered water resistive air and vapor barrier consisting of an SBS rubberized asphalt compound, integrally laminated to a yellow engineered thermoplastic film. Basis of design shall be Henry Blueskin TWF Self-Adhered Thru-Wall Flashing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance. It is the Waterproofing, Dampproofing, and Caulking Contractor's responsibility to verify the substrate is in accordance with the air and vapor barrier manufacturer's requirements and as specified in this section prior to the installation of the air barrier. Commencement of the work or any parts thereof indicates acceptance of the substrate.
1. Verify that masonry substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
4. Verify that masonry joints are flush and completely filled with mortar. Fresh CMU mortar joints shall cure for a minimum of 36 hours.
5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D4258.

G. Bridge and cover isolation joints, expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping modified bituminous strips.

H. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.03 INSTALLATION

A. Coordinate the installation and transitions of air and vapor barrier with the installation of masonry and metal thru-wall flashing (by the Masonry Contractor), roofing vapor retarder (by the Roofing and Flashing Contractor), and waterproofing (by the Waterproofing, Dampproofing, and Caulking Contractor) to ensure continuity of air barrier.

B. Environmental Requirements:
1. Do not perform work during rain or inclement weather.
2. Do not perform work on frost covered or wet substrates; can be applied to damp surfaces.
3. Do not perform work when ambient (air) and substrate temperatures are below 40 °F.

C. Refer to Air and Vapor Barrier Manufacturer's detail drawings for installation procedures including, but not limited to, the following:
1. Changes in substrate.
2. Control joints.
3. Crack treatment.
4. Inside corners.
5. Outside corners.
6. Penetrations.
7. Rough openings.
8. Sheathing Joints.

D. Primary Air Barrier:
1. Install air barrier assembly in accordance with Air Barrier Manufacturer's product specific TDS, details, guide specification, and technical bulletins to create a monolithic air and watertight application without sags, runs or voids.
2. Lap air barrier onto flashing (1) inch (25mm) minimum.
3. Application Rate: Application rates and cured dry film thickness are approximate, and may vary depending on texture and porosity of surface.
   a. Smooth surfaces:
      1) Wet film thickness (WFT): 60 mils.
      2) Dry film thickness (DFT): 36 mils.
   b. Rough surfaces:
      3) Wet film thickness (WFT): 90 mils.
      4) Dry film thickness (DFT): 54 mils.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections shall include the following:
   1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Continuous structural support of air barrier system has been provided.
   3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
   4. Site conditions for application temperature and dryness of substrates have been maintained.
   5. Maximum exposure time of materials to UV deterioration has not been exceeded.
   6. Surfaces have been primed.
   7. Air barrier has been firmly adhered to substrate.
   8. Compatible materials have been used.
   9. Transitions at changes in direction and structural support at gaps have been provided.
   10. All penetrations have been sealed.

C. Tests:
   1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E1186.
   2. Quantitative Air Leakage Testing: Testing not to exceed the test pressure differential, positive and negative, indicated in "Performance Requirements" Article for air barrier assembly air leakage according to ASTM E783.

D. Remove and replace deficient air barrier components and retest as specified above.

3.05 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

B. Clean spills, stains, and soiling from adjacent construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Check area to ensure cleanliness and remove debris, equipment, and excess material from the site.

END OF SECTION

SECTION 07500

MEMBRANE ROOFING

(PART OF WORK OF SECTION 07201 – ROOFING AND FLASHING FILED SUB-BIDS, Filed Sub-Bid Required)

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work of this Section includes all labor, materials, tools, staging, and equipment necessary to complete the roofing and flashing work as required by the Contract Documents. Such work includes, but is not limited to, the following:
   1. Fully Adhered 60 mil EPDM membrane roofing system warrantied for 20 years.
   2. Cover protection board over fully adhered insulation, under membrane.
   3. Roof insulation.
   4. Vapor retarder.
   5. Perimeter membrane flashings.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
   1. Section 06100 - Rough Carpentry for providing wood blocking.
   2. Section 07620 - Flashing and Sheet Metal for providing flashings integral to this work.

1.02 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.03 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Roofing system shall be designed to withstand Code required loads.

D. Flashings: Provide flashings, perimeter flashings, detail flashings and component materials that comply with requirements and recommendations in NRCA Roofing and Waterproofing Manual (Fourth Edition) for Construction Details and SMACNA Architectural Sheet Metal Manual (Fifth Edition) for Construction Details, as applicable.

E. Black EPDM Solar Reflectance Index: Not less than 29 when calculated according to ASTM E1980, based on testing identical products by a qualified testing agency.

1.04 SUBMITTALS

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

B. Shop Drawings and submittals shall be provided in accordance with Section 01300 within 30 calendar days after the Contractor has received the Owner's Notice to Proceed for the roofing system. Include plans, elevations, sections, details, and attachments to other Work.
1. Roof flashings and membrane terminations.
2. Insulation fastening patterns.
3. Location of the Roof Penetration Systems.

C. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

D. Qualification Data: For Installer and manufacturer.

E. Maintenance Data: For roofing system to include in maintenance manuals.

F. Inspection Report: Copy

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain components for roofing system from or approved by roofing system manufacturer.

B. Pre-installation Conference: Conduct conference at Project site. Comply with requirements in Division 01. Review methods and procedures related to roofing system including, but not limited to, the following:
1. Meet with the Owner and Engineer; testing and inspecting agency representative; roofing installer; roofing system manufacturer's representative; deck installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

10. Coordinate final locations and documentation of roof penetration systems.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

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

1.07 PROJECT CONDITIONS

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

1.08 WARRANTY

A. Roofing Contractor’s Warranty: The roofing contractor shall supply Owner with a minimum two-year workmanship warranty for each roof. In the event any work related to the roofing, flashing, or metalwork is found to be defective within two (2) years of Substantial Completion, the roofing contractor shall remove and replace such at no additional cost to the Owner. The roofing contractor’s warranty obligation shall run directly to the Owner, and a copy the roofing signed warranty shall be sent to the roofing system’s manufacturer.
   1. The duration of the roofing contractor’s two (2) year warranty shall run concurrent with the roofing system manufacturer’s twenty (20) year warranty.

B. Roofing Systems Manufacturer’s Warranty: The roofing manufacturer shall guarantee roof areas to be in a watertight condition, for a period of twenty (20) years, from the date of Substantial Completion. The warranty shall be a twenty (20) year no dollar limit (NDL), non-prorated total system labor and material warranty, for wind speeds up to 55 miles per hour. Total system warranty shall include all roofing materials, related components and accessories including, but not limited to the substrate board, vapor retarder, insulation board, cover board, roofing membrane, membrane flashings, fasteners, adhesives, metal roof copings, metal roof edges and termination metals. The manufacturer shall repair defects in materials and workmanship as promptly after observation as weather and site conditions permit.

PART 2 PRODUCTS

2.01 GENERAL

A. The roofing system shall be installed by a contractor who is currently approved in writing by the manufacturer of the roofing system.

B. The roofing system shall have the current approval of Underwriters Laboratories (UL) as a Class A roofing system.

C. The roofing system materials shall be supplied from a single manufacturer to ensure system responsibility.
   1. No materials shall be used which would compromise the manufacturer's warranty.

D. A technical representative of the roofing system manufacturer shall make three (3) individual site visits.
   1. Prior to the start of any roofing work,
   2. During the installation,
   3. At the completion of the work,
   4. All of the above is to ascertain that the roofing systems have been installed to the manufacturer's requirements.

2.02 EPDM ROOFING MEMBRANE

A. EPDM Roofing Membrane: ASTM D4637, Type I, non-reinforced uniform, flexible sheet made from EPDM, and as follows:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work:
      a. Carlisle SynTec Incorporated.
      b. Versico Roofing Systems.
      c. Or equal.
   2. Thickness: 60 mils nominal.
   3. Black Exposed Face.
   4. Physical Properties:

a.	Tolerance on nominal thickness	+/- 10% (ASTM D412)
b.	Weight	0.39 lbm/ft^2
c.	Tensile strength, minimum	1,600 psi (ASTM D412)
d.	Ultimate elongation, minimum	465% (ASTM D412)
e.	Tear resistance, minimum	200 lb-ft/inch (ASTM D624)
f.	Ozone resistance	ASTM D1149
g.	Resistance to outdoor weathering	ASTM G26
h.	Resistance to water absorption	ASTM D471
i.	Sheet composition	ASTM D297
j.	Brittleness temperature	ASTM D746
k.	Water vapor permeance	ASTM E96

2.03 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
   1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.

C. Bonding Adhesive: Manufacturer's standard bonding adhesive.

D. Seaming Material: Manufacturer's standard synthetic-rubber polymer primer and 3-inch-wide minimum with cover strip or 6-inch-wide, butyl splice tape with release film.

E. Lap Sealant: Manufacturer's standard single-component sealant, color to match roofing membrane.

F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

G. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel, approximately 1 by 1/8 inch thick; with anchors.

H. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

I. Miscellaneous Accessories: Provide pourable sealers, preformed cone, and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.04 VAPOR RETARDER

A. Vapor Retarder:
1. Provide self-adhering vapor retarder, 40-mil composite, consisting of 35 mils of self-adhering rubberized asphalt laminated to a 5-mil polyolefin film.
2. Include accessory components as required for a complete vapor retarder system below roofing.

B. Vapor Barrier Primer:
1. Provide primer compatible with substrate deck to permit full bonding of vapor retarder.

2.05 INSULATION

A. Rigid Insulation: Roof insulation shall be UL and FM approved. Insulation shall be approved in writing by the insulation manufacturer for intended use and for use with the specified roof assembly. Maintain a maximum panel size of 4 feet by 4 feet where polyisocyanurate insulation is specified to be installed in insulation adhesive.

B. Acceptable types are as follows.
1. Sarnatherm ISO by RMax.
2. EnergyGuard by GAF Materials Corp.
3. InsulBase HD by Carlisle.
4. Approved Equal.

C. Provide flat stock polyisocyanurate insulation with integral glass fiber facers in full compliance with ASTM C1289, Type II, Class 1, Grade 2.

D. Insulation shall have an area weighted aged U-Factor of min. 0.032 in accordance with the Long-Term Thermal Resistance (LTTR) value in accordance with ASTM C518 and the 10th Edition Massachusetts State Building Code.

E. Tapered crickets: provide polyisocyanurate insulation crickets in accordance with ASTM C1289, Type II, Class 1, Grade 2. Crickets shall provide for minimum slope of ½-inch per foot.

2.06 COVER BOARD

A. Substrate Board:
1. Provide 1/2" thick Dens Deck Prime board as manufactured by USG Corporation, CertainTeed Corporation, Temple-Inland, Inc., or equal.
3. Substrate Board shall consist of fiberglass mats front and back that are mechanically bonded to a high-density gypsum core.
4. Substrate Board to be highly resistant to the growth of mold when tested, as manufactured, per ASTM D3273.

2.07 COLD ADHESIVE

A. Cold Fluid-Applied Adhesive: Two component, cold process, asbestos free, low rise polyurethane foam adhesive. Adhesive shall be approved in writing by the membrane manufacturer and included as part of the warranty coverage.

2.08 SHEET METAL FLASHINGS

A. Roofing contractor shall provide metal flashing in accordance with Section 07620 Metal Flashing and Trim.

2.09 ROOF WALKWAYS

A. Nonskid black molded rubber walk pads, 30 inches by 30 inches by 3/8-inch nominal.

B. Walkways from one of the following are acceptable:
1. Carlise Syntec; EPDM Walkway Pads, or equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

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

B. Allow moist deck sections to dry prior to application of the new roof system. Open flames are prohibited from the roof area.

C. Complete terminations and flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.03 VAPOR RETARDER AND AIR BARRIER INSTALLATION

A. Provide primer when recommended by vapor-retarder manufacturer.

B. Apply vapor retarder from low to high point, in a shingle fashion, so that laps will shed water. Overlap all edges at least 3" minimum. End laps shall be staggered. Place membrane carefully to avoid wrinkles and fishmouths. Immediately after installation, roll with a 100 to 150-pound weighted steel roller.

C. Following application, inspect the vapor retarder for tears, punctures, fishmouths, air bubbles and voids due to misalignment at seams.
   1. Remove damaged membrane.
   2. Prime exposed substrates and allow primer to dry.
   3. Apply a new section of the vapor retarder to the primed substrate extending onto adhered membrane 6" on all sides. Firmly press vapor retarder repair section for a good seal.
   4. Slit fishmouths and overlap edges. Place a section of the vapor retarder over the repair and extend 6" in all directions. Firmly press repair section for a good seal.

D. Completely seal vapor retarder at side laps, end laps, terminations, obstructions, and penetrations to prevent air movement into roofing system.

E. Continuity of Roof Vapor Retarder is required.

3.04 ROOF INSULATION:

A. Install thickness necessary to meet specifications required and as shown on the Contract Drawings, with more stringent thickness required.

B. Provide sumps around roof drains.

C. Fasten insulation so that it will meet uplift requirements of Factory Mutual.

D. Position boards of first layer so end joints are staggered and edges parallel to deck span are supported by roof deck.

E. Install additional layers with joints staggered or offset from those below.

F. On Metal Roof Deck:
   1. Mechanically fasten 100-percent with a Factory Mutual approved fastener in the pattern and quantity recommended by insulation or mechanical fastener manufacturer to meet Factory Mutual requirements.
   2. Provide a minimum of one fastener per 2 square feet of insulation board, unless otherwise specified by manufacturer.

G. Loose lay insulation over the substrate with insulation joints 1/4 inch or less in width.

H. Do not install more insulation each day than can be covered with membrane before end of day or start of inclement weather.

3.05 COVERBOARD INSTALLATION

A. Coordinate installing membrane roofing system components, so insulation and cover board are not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation and cover board.

3.06 ADHERED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.

B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.

E. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

G. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.

H. Repair tears, voids, and lapped seams in roofing that does not meet requirements.

I. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

J. Apply epichlorohydrin sheet over roofing membrane at locations indicated.

3.07 FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings.

3.08 FIELD QUALITY CONTROL

A. Manufacturer’s Technical Representative: Engage a qualified manufacturer’s technical representative to perform roof tests and inspections and to prepare test reports.

B. Final Roof Inspection: Engage roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Engineer.
   1. Notify Engineer and the Owner 48 hours in advance of date and time of inspection.

C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Roofing Contractor’s expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.09 CLEANING AND PROTECTION

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

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

D. Do not permit traffic over unprotected finished roof surface.

END OF SECTION

SECTION 07620

METAL FLASHING AND TRIM

(PART OF WORK OF SECTION 07201 – ROOFING AND FLASHING FILED SUB-BIDS, Filed Sub-Bid Required)

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work of this Section includes all labor, materials, tools, staging, and equipment necessary to complete the metal flashing and trim work as required by the Contract Documents. Such work includes, but is not limited to, the following:
   1. Sheet metal flashing and trim for the following roofing applications:
      a. Counterflashing.
      b. Roof-Penetration Flashing.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
   1. Section 04200 – Unit Masonry for through-wall flashings in masonry.
   2. Section 06100 – Rough Carpentry for wood nailers, curbs, and blocking.
   3. Section 07500 – Membrane Roofing for EPDM membrane roofing materials.

1.02 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg. F, ambient; 180 deg. F material surfaces.

C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings and submittals shall be provided in accordance with Section 01300 within 30 calendar days after the Contractor has received the Owner's Notice to Proceed. Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
1. Sheet Metal Flashing: 12 inches long. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: Full-size Sample.

1.04 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

B. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01.
1. Meet with the Owner, Engineer and Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights if applicable, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.06 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 PRODUCTS

2.01 SHEET METALS

A. Zinc-Tin Alloy-Coated Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 temper, of minimum uncoated weight (thickness) indicated; coated on both sides with zinc-tin alloy (50 percent zinc, 50 percent tin).
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Revere Copper Products, Inc.; FreedomGray.

2.02 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
   1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
   2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
   3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

C. Solder for Zinc-Tin Alloy-Coated Copper: ASTM B32, 100 percent tin, with maximum lead content of 0.2 percent, as recommended by sheet metal manufacturer.

D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape.

E. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

G. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.03 GENERAL FABRICATION

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   1. Seams: Fabricate nonmoving seams in accessories with flatlock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
   1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

H. Counterflashing: Fabricate from the following material:
   1. Zinc-coated Copper: 16 oz./sq. ft. (0.55 mm thick).

I. Roof-Penetration Flashing: Fabricate from the following material:
   1. Zinc-coated Copper: 20 oz./sq. ft. (0.68 mm thick).

2.04 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing in Masonry: Through-wall flashing in masonry is specified in Section 04200 – Unit Masonry, and shall be furnished and installed by the Masonry Contractor.

2.05 FINISHES

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

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

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 GENERAL INSTALLATION

A. General: Anchor sheet metal flashing and trim and other components of the work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
   1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip-sheet or install a course of polyethylene underlayment.
   2. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use 304/316 stainless steel fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

H. Seal joints with elastomeric sealant as required for watertight construction.
   1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg. F

set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg. F.

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pre-tinned surface would show in finished Work.

1. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.03 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07720

ROOF SPECIALTIES AND ACCESSORIES

(PART OF WORK OF SECTION 07201 – ROOFING AND FLASHING FILED SUB-BIDS, Filed Sub-Bid Required)

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work of this Section includes all labor, materials, tools, staging, and equipment necessary to complete the roof specialties and accessories as required by the Contract Documents. Such work includes, but is not limited to, the following:
   1. Roof hatch.
   2. Roof equipment and pipe curbs.
   3. All roof hatches and curbs shall be furnished and installed by the Roofing and Flashing Contractor under this specification section for all equipment as shown on the Drawings.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
   1. Section 06100 - Rough Carpentry for providing wood blocking.
   2. Section 07500 – Membrane Roofing for EPDM membrane roofing materials.
   3. Section 07620 - Flashing and Sheet Metal for providing flashings integral to this work.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product data.

B. Shop Drawings and submittals shall be provided in accordance with Section 01300 within 30 calendar days after the Contractor has received the Owner's Notice to Proceed. Shop drawings shall include profiles, accessories, location, adjacent construction interface, and dimensions.

C. Warranty: Submit executed copy of manufacturer's standard warranty.

1.03 QUALITY ASSURANCE

A. Manufacturer: A minimum of 5 years experience manufacturing similar products.

B. Installer: A minimum of 2 years experience installing similar products.

C. Manufacturer's Quality System: Registered to ISO 9001 Quality Standards including in-house engineering for product design activities.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.05 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 PRODUCTS

2.01 ROOF HATCH

A. Furnish and install metal roof hatch where indicated on the Drawings, Model No. F-50TB, as manufactured by the BILCO Company, New Haven, CT, or approved equal. The size of the roof hatch shall be: width - 48" x length - 48". Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.

B. Performance characteristics:
1. Cover shall be reinforced to support a minimum live load of 40 psf with a maximum deflection of 1/150th of the span or 20 psf wind uplift.
2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
3. Operation of the cover shall not be affected by temperature.
4. Entire hatch shall be weathertight with fully welded corner joints on cover and curb.

C. Cover: Shall be 11 gauge aluminum with a 3" beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

D. Cover insulation: Shall be fiberglass of 1" thickness, fully covered and protected by an 18 gauge aluminum liner.

E. Curb: Shall be 12" in height and of 11 gauge aluminum. The curb shall be formed with a 3-1/2" flange with 7/16" holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, including stamped tabs, 6" on center.

F. Curb insulation: Shall be rigid, high-density fiberboard of 1" thickness on outside of curb.

G. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent

accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe welded to the curb assembly.

H. Hardware
1. Heavy pintle hinges shall be provided
2. Cover shall be equipped with a spring latch with interior and exterior turn handles
3. Roof hatch shall be equipped with interior and exterior padlock hasps.
4. The latch strike shall be a stamped component bolted to the curb assembly.
5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" diameter red vinyl grip handle to permit easy release for closing.
6. Hardware: All hardware shall Type 316 stainless steel.
7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

I. Finishes: Factory finish shall be mill finish aluminum.

2.02 EQUIPMENT SUPPORT CURBS

A. Prefabricated Galvanized Steel: Minimum 12-inch-high curb with counterflashing, factory installed insulation, and treated wood nailer as required for conditions shown on Drawings.

B. Metal Gauge and Reinforcement: To suit imposed loads of equipment to be supported.

C. Fabricate curbs to fit roof slope.

D. Manufacturers and Products:
1. Pate Co.; ES-2.
2. Thy Curb; Model TEMS-3.
3. RPS Corporation; ER-2A.

2.03 PIPE CURB ASSEMBLY

A. Prefabricated Galvanized Steel: Minimum 12-inch high curb for pipe penetrations of roof, complete with cover, liner panel, factory installed insulation and accessories as required for conditions shown on Drawings.

B. Fabricate to fit roof slope and furnish covers to suit pipe penetrations indicated on Drawings.

C. Manufacturers and Products:
1. Pate Co.; PCA-2, with cover.
2. Thy Curb; Model TC-3, with cover.
3. RPS Corporation; Pipe Portal System.

2.04 PIPE SEALS

A. Prefabricated one-piece aluminum flanged base with stepped, graduated EPDM cap and adjustable 316 stainless steel clamps.

B. Manufacturers and Products:
   1. Pate Co.; Pipe Seal.
   2. Portals Plus, Inc.; Alumi-Flash.
   3. RPS Corporation; Alumi-Flash.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION

A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.
   1. Test units for proper function and adjust until proper operation is achieved.
   2. Repair finishes damaged during installation.
   3. Restore finishes so no evidence remains of corrective work.

3.03 ADJUSTING AND CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

END OF SECTION

SECTION 07920

JOINT SEALANTS

(PART OF WORK OF SECTION 07101 – WATERPROOFING, DAMPPROOFING AND CAULKING FILED SUB-BIDS, Filed Sub-Bid Required)

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work of this Section includes all labor, materials, tools, staging, and equipment necessary to provide joint sealants, complete, as required for the applications specified herein and as indicated on Drawings.

1. At a minimum sealant shall be provided at the following locations and any other locations noted on the Drawings:
    a. Window frames (head, jamb and sill: inside and outside).
    b. Door frames (head and jambs; inside and outside).
    c. All masonry control joints.
    d. Concrete construction and control joints, where required.
    e. Louver frames (head, jamb and sill; inside and outside).
    f. Pre-molded filler at floor wall interface.
    g. Interface between mechanical and plumbing fixtures, equipment, and casework included in Division 12 and Division 15 at walls and floors, as required.
    h. Firestopping shall be provided at penetrations through fire rated walls, floors, and ceilings.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 08800 - Glazing for glazing sealants.
2. Section 09300 – Tile for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
3. Section 09500 – Acoustical Tile for sealing edge moldings at perimeters of acoustical ceilings.
4. Section 09900 – Painting.

1.02 PERFORMANCE REQUIREMENTS

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

B. Provide joint sealants for interior applications that establish and maintain airtight and water resistant continuous joint seals without staining or deteriorating joint substrates.

1.03 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Shop Drawings and submittals shall be provided in accordance with Section 01300 within 30 calendar days after the Contractor has received the Owner's Notice to Proceed for the joint sealants. Show locations and extent of joint sealants.

C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Qualification Data: For Installer.

E. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

F. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

G. Field Test Report Log: For each elastomeric sealant application.

H. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized installer who is approved or licensed for installation of elastomeric sealants required for this Project. Proper installer certifications shall be submitted prior to construction as required herein.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

3. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
4. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as required by the Engineer.
2. Conduct field tests for each application indicated below:
   a. Each type of elastomeric sealant and joint substrate indicated.
   b. Each type of non-elastomeric sealant and joint substrate indicated.
3. Notify Engineer seven days in advance of dates and times when test joints will be erected.
   a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193.
      i. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
4. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

E. Pre-installation Conference: Conduct conference at Project site.
1. Include installers of other construction connecting to joint sealants, such as concrete, masonry, and plumbing.
2. Review joint sealant requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

1.05 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are greater than or less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.06 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
   1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.01 GENERAL MATERIALS

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Architectural Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors of Exposed Joint Sealants: To be selected by the Owner based on manufacturer's available color designations.

2.02 JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Elastomeric sealants shall be non-staining to porous substrates. Provide products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Potable Water: Where elastomeric sealants are indicated for joints that will come in contact with potable water including, but not limited to, joints in tanks, provide products that are NSF 61 Certified.

D. Single-Component Neutral-Curing Silicone Sealant:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Dow Corning Corporation; 790.
   b. Tremco Inc.; Spectrem 1.
   c. Sika; SP 101
2. Extent of Use: Joints in exterior vertical and soffit surfaces.

E. Multicomponent Pourable Urethane Sealant:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Meadows, W. R., Inc.; POURTHANE.
   b. Pecora Corporation; Urexpan NR-200.
2. Extent of Use: Joints in exterior horizontal surfaces.

F. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Dow Corning Corporation; 786 Mildew Resistant, or equal.
2. Extent of Use: Sanitary joints at bathrooms.

G. Latex Sealant: Comply with ASTM C834, Type P, Grade NF.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Pecora Corporation; AC-20+.
   b. SIKA; Sikaflex-521 UV.
2 Extent of Use: Non-moving joints at interior locations.

H. Polyurethane elastomeric sealant: Comply with ASTM C920, type M, Grade NS, Class 25.
1. Available Products: Subject to compliance with the requirements, products that may be incorporated in the Work include, but are not limited to, the following:
   a. Sika; Sikaflex – 2c NS EZ
   b. Other sealants suitable for submersible use and vertical application.
2. Extent of Use: Concrete joints, vertical and horizontal in submersible locations.

I. Firestopping sealant shall be an endothermic, water based fire protection sealant.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. 3M; Interam FireDam 150 or approved equal.
   2. Extent of Use: Metal pipe and conduit penetrations through fire rated walls, floors, and ceilings.

2.03 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.04 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include concrete and masonry.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include metal, glass, and porcelain enamel.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint configuration per Figure 5A in ASTM C1193, unless otherwise indicated.

3.04 CLEANING

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

3.05 PROTECTION

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

END OF SECTION

INDEX

DIVISION 8 DOORS AND WINDOWS

SECTION 08100

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – General Requirements, which are hereby made a part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
   1. Standard hollow-metal steel doors.
   2. Standard hollow-metal steel frames.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
   1. Section 04200 – Unit Masonry for building anchors into and grouting steel frames in masonry construction.
   2. Section 08710 – Door Hardware for door hardware for steel doors.
   3. Section 08800 - Glazing for glazed lites.
   4. Section 09900 - Painting for field painting steel doors and frames.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, temperature-rise ratings, and finishes for each type of steel door and frame specified.

B. Shop Drawings:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings, removable stops, and glazing.

C. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

D. Qualification Data: For Installer.

E. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.

C. Fire-Rated Door, Sidelight and Transom Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.
   1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
   1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.07 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Doors shall accommodate glass of type and thickness indicated and as specified in Section 08800 Glazing. Glass and glazing shall be provided by the Glass and Glazing Contractor under Section 08800.

PART 2 PRODUCTS

2.01 MATERIALS

A. Shall meet the following requirements:
   1. Galvanized steel sheets complying with ASTM A526, G90 coating designation.
   2. Supports and anchors to be fabricated with no less than 16 gauge sheet metal galvanized after fabrication in compliance with ASTM A153, Class B.
   3. Bolts and fasteners to be hot dip galvanized in compliance with ASTM A153, Class C or D.
   4. Rust-inhibitor metal primer capable of being baked and compatible with the finish painting system as specified in Section 09900. Manufacturer shall furnish documentation from primer manufacturer and top coat paint manufacturer to certify primer is compatible with top coat paints provided under Section 09900. General Contractor shall coordinate with all Painting Contractor to verify compatibility.

2.02 FABRICATION

A. Doors:
   1. Doors shall be fabricated from 16-gauge galvanized material.
   2. Doors shall have smooth, flush surfaces free from visible joints or seams on exposed faces of stile edges except at glazed or louvered panel inserts.
   3. Door top to be waterproof and door bottom shall be provided with weep holes.
   4. Doors shall be flush type, hollow steel construction, 1-3/4 inches thick.
   5. Doors shall be sound deadened, reinforced, stiffened and insulated with impregnated Kraft honeycomb core, completely filling the inside face of both panels.
   6. Reinforce doors with rigid tubular frame where stiles and rails are less than 8 inches wide.
   7. Bevel doors, hinge and lock edges 1/8-inch in two inches.
   8. Provide additional reinforcement for all finish hardware, mortise and surface mounted.
   9. Fire Rated Doors:
      a. Conform to NFPA 80 when tested by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual for the class of door or door opening shown.
      b. Shall have a 60-minute fire protection rating.
      c. Fire rated labels of metal, with raised or incised markings of approving laboratory shall be permanently attached to doors.
      d. Close top and vertical edges of doors flush. Vertical edges shall be seamless. Apply steel astragal to the meeting stile of the active leaf of pairs of fire rated doors, except where vertical rod exit devices are specified for both leaves swinging in the same direction.

B. Door Frames
   1. Provide galvanized pressed metal frames with profiles as shown on the Drawings.
   2. Frame material shall be a minimum of 14 gauge.
   3. Frame shall be of the integral construction type, welded continuous to full depth of frame with a minimum 5/8-inch-deep stop.