SECTION 01 45 23 - STRUCTURAL TESTING AND INSPECTION SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

A. The testing laboratory shall make all inspections and perform all tests in accordance with the building code, local authorities, ASTM specifications and the Contract Documents.

B. The testing laboratory shall provide as a part of the project's close-out documents or as required by any regulatory authority, all appropriate signed and sealed Special Inspection Certificates whose purpose would be to provide consistency and direction for compliance with the referenced Building Code. These Special Inspection Certificates shall confirm that that all work requiring special inspection has been adequately performed, and the special inspections have been made by an individual or firm that is qualified to make special inspections per the referenced Building Code.

C. Materials and workmanship not meeting the required standards are to be removed and replaced. Replacement and subsequent testing shall be at the expense of the Contractor.

D. Testing, inspection, and certifications specified in other sections of these Specifications shall be paid by the Owner, unless otherwise indicated.

E. Inspection by the laboratory shall not relieve the Contractor or Fabricator of his responsibility to furnish materials and workmanship in accordance with the Contract Documents.

1.3 REFERENCED STANDARDS

A. The latest adopted edition of all standards referenced in this Section shall apply, unless noted otherwise.

B. ACI 311 – ACI Manual of Concrete Inspection

C. ACI 301 - Specification for Structural Concrete

D. In case of conflict between these Contract Documents and a referenced standard, the Contract Documents shall govern. In case of conflict between these Contract Documents and the Building Code, the more stringent shall govern.

1.4 QUALITY ASSURANCE

A. Testing Laboratory shall meet the requirements of ASTM E329 and ASTM E543.

B. Testing Laboratory shall be insured against errors and omissions by a professional liability insurance policy having a limit of liability not less than $500,000.

C. Testing Laboratory shall be under the direction of a Registered Engineer who is legally authorized to practice in the jurisdiction where Project is located and having at least five years experience in inspection and testing of construction materials.

D. Laboratory staff monitoring concrete work shall be ACI certified inspectors.

E. Laboratory staff performing structural steel inspection shall be currently certified AWS Certified Welding Inspectors (CWI), in accordance with the provisions of AWS QCI, "Standard and Guide for Qualification and Certification of Welding Inspectors". The inspector may be supported by assistant inspectors who may perform specific inspection functions under the supervision of the inspector. Assistant inspectors shall be currently certified AWS Certified Associate Welding Inspectors (CAWI). The work of the assistant inspectors shall be regularly monitored by the inspector, generally on a daily basis.

F. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

1.5 LABORATORY RESPONSIBILITIES

A. Attend preconstruction meetings and progress meetings as required to coordinate work with the Contractor and address quality control issues.

B. Test samples of design mixes submitted by Contractor.

C. Provide qualified personnel at site. Cooperate with Architect/Engineer and Contractor in performance of services.

D. Perform specified inspecting, sampling, and testing of Products in accordance with specified standards.

E. Ascertain compliance of materials and mixes with requirements of Contract Documents.

F. Promptly notify Architect/Engineer and Contractor of observed irregularities or non conformance of Work or Materials.

G. Perform all inspections and tests in accordance with building code requirements for "Special Inspection" whether or not such inspections are specified in the Contract Documents.

H. Testing Laboratory shall write a letter at the completion of the project, signed and sealed by a registered engineer in the state of the project, summarizing the inspections performed, the dates they were performed, and whether the observed construction complied with the Contract Documents.

1.6 LABORATORY REPORTS

A. After each inspection and test, promptly submit copies of laboratory reports to Architect, Engineer, Owner and to Contractor.

B. Include:

1. Date issued
2. Project title and number
3. Name of inspector
4. Date and time of sampling or inspection

5. Identification of product and specifications section
6. Location in the Project
7. Type of inspection or test
8. Date of test
9. Results of tests
10. Conformance with Contract Documents

1.7 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge the requirements of the Contract Documents.

B. Laboratory may not approve or accept any portion of the Work, except where such approval is specifically called for in these specifications.

C. Laboratory may not assume any duties of Contractor.

D. Laboratory has no authority to stop the Work.

1.8 CONTRACTOR RESPONSIBILITIES

A. See technical sections of these specifications for specific requirements.

B. Deliver to the laboratory, without cost to the Owner, adequate samples of materials proposed for use which are required to be tested.

C. Advise laboratory sufficiently in advance of construction operations to allow laboratory to complete any required checks or tests and to assign personnel for field inspection and testing as specified.

D. Provide facilities for safe storage and proper curing of concrete test samples on project site for the first 24 hours and also for subsequent field curing as required by ASTM specifications C31.

E. Provide incidental labor and equipment as required to assist laboratory personnel in obtaining and handling samples at the site and in accessing work for inspection.

F. Furnish concrete mix designs, in accordance with ACI 301, section 3.9, made by an independent testing laboratory or qualified concrete supplier. Where mix designs are required, the laboratory shall be selected and paid by the Contractor.

G. Provide current welder certifications for each welder to be employed.

H. Furnish fabrication and erection inspection of all welds in accordance with AWS D1.1, Chapter 6.

I. Prequalification of all welding procedures to be used in executing the work.

PART 2 - PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

3.1 PIER DRILLING

A. A representative of the Owner's Geotechnical Engineer shall provide the services specified in this section.

B. The laboratory representative shall make continuous inspections to determine that the proper bearing stratum is obtained and that shafts are clean and dry before placing concrete.

C. The laboratory shall furnish complete pier log showing the diameter, top and bottom elevations of each pier, whether or not casing is required, bell size (if required), actual penetration into bearing stratum, and elevation of top of bearing stratum.

3.2 CONCRETE REINFORCING STEEL AND EMBEDDED METAL ASSEMBLIES

A. Inspect all concrete reinforcing steel prior to placing of concrete for compliance with the Contract Documents and approved shop drawings. All instances of noncompliance shall be immediately brought to the attention of the Contractor for correction. If uncorrected by the Contractor, they shall be listed in the report.

B. Observe and report on the following:

1. Number and size of bars
2. Bending and lengths of bars
3. Splicing
4. Clearance to forms including chair heights
5. Clearance between bars or spacing
6. Rust, form oil, and other contamination
7. Grade of Steel
8. Securing, tying and chairing of bars
9. Excessive congestion of reinforcing steel
10. Installation of anchor bolts and placement of concrete around anchor bolts
11. Fabrication and installation of embedded metal assemblies, including visual inspection of all welds.
12. Visually inspect studs and deformed bar anchors on embedded assemblies for compliance with Contract Documents

C. Provide a qualified, experienced inspector to inspect reinforcing steel. Inspector shall have a minimum of three years experience inspecting reinforcing steel in projects of similar size.

3.3 CONCRETE INSPECTION AND TESTING

A. Secure composite samples of concrete at the jobsite in accordance with ASTM C172.

B. Mold and cure three specimens from each sample in accordance with ASTM C31. The test cylinders shall be stored in the field 24 hours and then carefully transported to the laboratory and cured in accordance with ASTM C31.

C. Test specimens in accordance with ASTM C39. One specimen shall be tested 7 days, two specimens shall be tested at 28 days for acceptance. A spare cylinder shall be made and kept for a 56-day break if the 28 day break does not meet strength requirements. If the plans require 56-day break (such as for mass concrete), two samples shall be tested at 56 days for acceptance.

D. Make one strength test (four or five cylinders) for each:
   1. 100 cubic yards or fraction thereof, of each mix design placed in one day.
   2. OR, for each 5000 sq. ft. of slab area placed in one day.
   3. When the total quantity of a given class of concrete is less than 25 cu. yds., the strength tests may be waived by the Architect/Engineer, if in his judgment, adequate evidence of satisfactory strength is provided.

E. Make one slump test for each set of cylinders following the procedural requirements of ASTM C143 and ASTM C172. Make additional slump tests whenever the consistency of the concrete appears to vary. Do not permit placement of concrete having measured slump outside the limits given on the drawings, except when approved by the Architect. Slump tests corresponding to samples from which strength tests are made shall be reported with the strength test results. Other slump tests need not be reported.

F. Determine total air content of air entrained normal-weight concrete sample for each strength test in accordance with ASTM C231.

G. Determine air content and unit weight of lightweight concrete sample for each strength test in accordance with ASTM C173 and ASTM C567.

H. Determine temperature of concrete sample for each strength test and one test for each concrete load discharged when air temperature is 80 degrees F. and above.

I. Monitor the addition of water at the jobsite and the length of time the concrete is allowed to remain in the truck before placement. Report any significant deviation from the approved mix design and the project requirements to the Architect, the Contractor, and the Concrete Supplier.

J. Monitor the slump and air content of the concrete. If the measured slump or air content of air entrained concrete falls outside the specified limits, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, the concrete shall be considered to have failed to meet the project requirements and specifications, and shall be rejected.

K. The testing laboratory shall certify each delivery ticket indicating class of concrete delivered (or placed), amount of water added and the time at which the cement and aggregate was dispensed into the truck, and the time at which concrete was discharged from the truck.

L. Laboratory reports shall contain the following information:

   1. Class of concrete and specific location.
   2. Specified strength of concrete.
   3. Air temperature.
   4. Batch time.
   5. Specified time that discharge of concrete must be completed, based on air temperature.
   6. Time concrete is placed.

7. Amount of water withheld at the plant for latter addition at the project site (Note that the total amount of water shall not exceed the maximum water/cement ratio for the approved mix design).
8. Amount of water added at the site.
9. Allowable slump range on the approved mix design.
10. Slump.
11. Maximum and minimum allowable concrete temperature on the approved mix design.
12. Temperature of the concrete mix.
13. Air content range on the approved mix design.
14. Air content.
15. Statement that concrete is in compliance with the project documents and the approved mix designs.

M. Evaluation and Acceptance:

1. The strength level of the concrete will be considered satisfactory if the averages of all sets of three consecutive strength test results are equal to or exceed the specified strength and no individual test result (average of two cylinders) is below the specified strength by more than 500 psi.
2. Completed concrete work will be accepted when the requirements of "Specifications for Structural Concrete for Buildings," ACI 301 have been met.

N. Observe the placing of all concrete, except site work. Observe and report on placing method, consolidation, cold joints, length of drop and displacement of reinforcing. Report deficiencies to the Contractor immediately for corrective action. Inspections may be reduced to a periodic basis when all procedures have been deemed satisfactory by the laboratory.

O. Comply with ACI 311, "Guide For Concrete Inspection" and "ACI Manual of Concrete Inspection" (SP-2).

P. Inspect the application of curing compound and monitor all curing conditions to assure compliance with Specification requirements. Report curing deficiencies to the Contractor immediately and submit a report to the Architect.

3.4 MASONRY

A. Inspection

1. Provide a qualified inspector to inspect all structural masonry work.
   a. Inspect masonry for compliance in accordance with the “Level 1 or 2 Special Inspection” provisions of the building code. Refer to the contract documents regarding which level of special inspections is required.
2. In combination with inspections required by the building code, inspect the following:
   a. Preparation of masonry prisms for testing.
   b. Placement of reinforcing.
   c. Cavities to be grouted (prior to grouting and prior to closing cleanouts).
   d. Mortar mixing operations, including proportion of materials and method of measuring materials (materials should be measured with a mixing box and not a shovel).
   e. Bedding of mortar for each type of unit and placing of units.
   f. Grouting operations.
   g. Condition of units before laying for excessive absorption.
3. Provide report of each inspection.

B. Field Compressive Tests for Grout:

1. Secure composite samples of grout at the jobsite in accordance with ASTM C 1019.
2. Mold and cure three specimens from each sample in accordance with ASTM C 1019. Supervise the curing protection provided (by others) for test specimens in the field and the transportation from the field to the laboratory. The test specimens shall be stored in the field 24 to 48 hours and then be carefully transported to the laboratory and cured in accordance with ASTM C 1019.
3. Test specimens in accordance with ASTM C 1019. Two specimens shall be tested at 28 days for acceptance and one specimen shall be tested at 7 days for information.
4. Make one strength test (three specimens) for each 10 cubic yards of grout poured but not less than one strength test for each 5000 square feet of wall area.

C. Prism Tests:

1. Build prisms at the jobsite using the same materials and methods as being used for the wall construction. Store prisms in a place where they will be undisturbed for two days and have approximately same curing conditions as masonry construction. After 48 hours, move prisms to the laboratory and test in accordance with ASTM C1314.
2. Make prism tests in advance of operations using materials under same conditions, with the same bonding and construction methods as is being used for the structure. When building prisms, moisture content of the units at time of laying, consistency of mortar and width and thickness of mortar joints shall be same as used in the structure.
3. Build prisms of hollow masonry units the same width as unit by 16" long by 16" high. Apply mortar to face shells only. Do not fill hollow core with grout. Compute value of ultimate net compressive strength, by dividing ultimate load by net face shell area of masonry units.
4. Cure and test prisms in accordance with applicable provisions of ASTM C1314. Test five specimens of each type of masonry unit before delivering material to the jobsite and submit results for approval. During construction, test three specimens of each type of masonry unit for each 5000 square feet of wall placed.
5. The prisms shall be tested after 28 days, but may be tested at seven days provided the relationship between seven and 28 day strengths has been established for the materials used prior to the start of construction.
6. When the average strength of a set of prisms falls below the specified compressive strength (f'm), the masonry corresponding to the test shall be deemed unacceptable. In such a case, notify the Architect and Contractor immediately.

3.5 STRUCTURAL STEEL

A. Inspect all structural steel during and after erection for conformance with Contract Documents and shop drawings.

B. Field Inspection

1. Proper erection of all pieces.
2. Proper installation of all bolts, including the checking of calibration of impact wrenches used with high strength bolts.
3. Plumbness of structure and proper bracing.
4. Field Painting.
5. Visual examination of all field welding.
6. Ultrasonic testing of all penetration welds.

7. Installation of field welded shear studs.
8. Measure and record camber of all beams upon arrival and before erection for compliance with the specified camber. Measure lying flat with web in horizontal position. Members outside specified camber tolerance shall be returned to the shop for remedial work.

C. Qualification of Welders: Fabricator and erector shall provide the testing laboratory with names of welders to be employed in the work, together with certification that welders have passed qualification tests within the last year using procedures specified in the AWS D1.1. Testing laboratory shall verify all welder's qualifications.

D. Inspection of shop and field welding shall be "verification inspection," in accordance with Section 6 of AWS D1.1 and as follows:

1. Visually inspect the welding of all shop fabricated members and note the location of all cover plates, connectors, bearing stiffeners, splices, and fillet welds for proper return around ends and check for seams, folds, and delamination.
2. Ultrasonically test all penetration welds in accordance with AWS D1.1.
3. Inspect surfaces to be welded. Surface preparations, fit-up and cleanliness of surface shall be noted.
4. The welding inspector shall be present during alignment and fit-up of members being welded, and shall check for correct surface preparation of root openings, sound weld metal, and proper penetration in the root pass. Where weld has not penetrated completely, the inspector shall order the joint to be chipped down to sound metal, or gouged out and rewelded. Root passes shall be thoroughly inspected for cracks. All cracks shall be gouged out and rewelded to two inches beyond each end of crack.
5. The inspector shall check that all welds have been marked with the welders symbol. The inspector shall mark the welds requiring repairs and shall make a reinspection. The inspector shall maintain a written record of all welds. Work completed and inspected shall receive an identification mark by the inspector.
6. The testing laboratory shall advise the Owner and the Architect of any shop and/or field conditions which, in his opinion, may require further tests and examination by means other than those specified. Such further tests and examinations shall be performed as authorized by the Owner and the Architect.
7. The Owner reserves the right to use ultrasonic or radiographic inspection to verify the adequacy of all welds. Testing procedures and acceptance criteria shall be as specified in AWS D1.1.

E. Inspection of bolted construction shall be in accordance with AISC "Specification for Structural Steel Buildings" and as follows:

1. All bolts shall be visually inspected to ensure that the plies have been brought into snug contact.
2. High strength bolting shall be inspected in accordance with Section 9 of the AISC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
3. For all high strength bolts, unless specifically noted on the Drawings to require only "snug-tight" installation, the inspector shall observe the required jobsite testing and calibration, and shall confirm that the procedure to be used provides the required tension.
4. For slip critical connections, inspect the contact surfaces for compliance with specifications prior to bolting.

F. Inspection of stud welding shall be in accordance with Section 7.8 of AWS D1.1 and as follows:

G. A minimum of two shear studs shall be welded at the start of each days production period in order to determine proper generator, control unit and stud welding setting. These studs shall be capable of being bent at 45 degrees from vertical without weld failure.

1. When the temperature is below 32 degrees Fahrenheit, one stud in each 100 shall be tested after cooling. Studs shall not be welded below zero degrees Fahrenheit or when the surface is wet due to rain, snow, or ice. If a stud fails, two new studs shall pass the test before resumption of the welding.
2. Visually inspect studs for compliance with the Contract Documents. Check number, spacing, and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet has not been obtained for a particular stud, such stud shall be struck with a hammer and bent 15 degrees off perpendicular. Studs failing this test shall be replaced.

3.6 OPEN WEB JOISTS AND JOIST GIRDERS

A. Inspect all joists either in the plant or at the jobsite for conformance with specified fabrication requirements. Check welded connections between web and chord, splices, and straightness of members. Inspection at the plant may be performed by the manufacturer's qualified QC personnel.

B. Inspect installation of joists at the jobsite. Check connections to supporting members, chord extensions, number of rows of bridging, and bridging connections for conformance with the Contract Documents and referenced standards.

C. Check welder qualification certificates for field welding operators.

3.7 STEEL ROOF DECK

A. Field inspection shall consist of the following:

1. Checking types, gauges, and finishes for conformance with the Contract Documents and Shop Drawings.
2. Examination for proper erection of all metal deck, including fastenings at supports and sidelaps, reinforcing of holes, and miscellaneous deck supports.
3. Certification of welders.
4. Visual inspection of at least 20 percent of all welds.

3.8 SPRAYED FIREPROOFING

A. Verify that applied thickness, density, and bond strength of sprayed fireproofing meets fire rating requirements of approved design.

B. Verify that installation meets fire rating requirements of approved design.

C. Inspect and test for thickness as follows:

1. Test 20 percent of structural frame columns and beams in each building level.
2. Test 10 percent of beams other than structural frame in each building level.
3. Test one slab per each 5000 square feet of building area.

D. Inspect and test for density on slabs, beams, and columns. Perform one of each test for each 10,000 square feet of building area.

E. Inspect and test for bond strength, one test for beams and one test for slabs for each 10,000 square feet or area.

F. Inspection and test procedures shall be performed in accordance with ASTM E605 and E736.

3.9 EXPANSION BOLT INSTALLATION

A. Inspect the drilling of each hole and installation of each expansion bolt for compliance with the Contract Documents.

B. Verify the installation torque for each expansion bolt for compliance with manufacturer's installation instructions.

3.10 TESTING OF NON-SHRINK GROUT

A. Make one strength test for every 15 base plates grouted and for every 15 bags of grout used in joints between members.

B. Each test shall consist of four cubes, two to be tested at seven days, and two at 28 days, made and tested in accordance with ASTM C109, with the exception that the grout shall be restrained from expansion by a top plate.

3.11 EXCAVATION

A. A representative of the Owner’s Geotechnical Engineer shall provide the services specified in this section.

B. Review geotechnical parameters and assumptions used in the development of calculations and drawings for retention systems, including lateral design forces, rock wedge stability analysis, rock bolt lengths and spacing, and surcharge effects.

C. Observe the excavation process, the exposed faces of the excavation and the installation of retention systems. Check for compliance with the Contract Documents and make alternative recommendations as may be required to suit field conditions.

D. Review required submittals as they pertain to geotechnical requirements.

E. Check the adequacy and accuracy of the Contractor's monitoring program, equipment, procedures, and measurements related to movements of the excavated face and adjacent structures.

F. Immediately report any observed unsafe conditions. Request additional shoring, bracing, or rock bolting where judged to be necessary as the excavation progresses.

3.12 FILLING AND BACKFILLING

A. A representative of the Owner’s Geotechnical Engineer shall provide the services specified in this section.

B. The Contractor shall make available to the laboratory, adequate samples of each fill and backfill material from the proposed sources of supply not less than 10 days prior to the start of the work.

C. Laboratory shall analyze samples as required to provide a soil description and to determine compliance with quality requirements. Perform the following tests:

1. Test for liquid limit in accordance with ASTM D423.
2. Test for plastic limit of soils and plasticity index of soils in accordance with ASTM D424.
3. Tests for moisture density relations of soil in accordance with ASTM D698 or D1557, as applicable.

D. Furnish a report for each individual test and state whether sample conforms to specified requirements or reasons for nonconformance.

E. Inspect underslab drainage material and placement for compliance with specified gradation, quality and compaction.

F. Make in-place compaction test for moisture content, moisture-density relationship, and density of fill material after compaction to determine that backfill materials have been compacted to the specified density. Number of tests shall be as follows:

1. One test for each 5000 square feet of area of each lift placed under floor slab. Stagger test locations in each lift from those in the previous lift. Perform a minimum of three tests for each lift.
2. One test for each 150 linear feet, or portion thereof, of each lift placed against foundation walls, with locations staggered from those in the previous lift.
3. One test of each lift placed below any isolated footing, and every 100 linear feet under continuous footings, with locations taken on a different side from that in the lift below.

END OF SECTION 01 45 23

SECTION 31 63 29 - DRILLED CONCRETE PIERS AND SHAFTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dry-installed drilled piers.

1.2 RELATED DOCUMENTS

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

1.3 UNIT PRICES

A. Unit prices are included in Section 01 22 00 "Unit Prices."

B. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length and shaft diameter may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments will be made on net variation of total quantities, based on design dimensions for shafts.

1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft and the diameter of shaft.
2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing and inspecting, and other items for complete drilled-pier installation.

1.4 SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Shop Drawings: For concrete reinforcement detailing fabricating, bending, supporting, and placing.

D. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.

E. Material Test Reports

F. Field quality-control reports.

G. Other Informational Submittals:

1. Record drawings.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in drilled-pier work.

B. Testing Agency Qualifications: Qualified according to ASTM C 1077, ASTM D 3740, and ASTM E 329 for testing indicated.

C. Drilled-Pier Standard: Comply with ACI 336.1 unless modified in this Section.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.

1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.

B. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify all affected parties including Owner no fewer than five (5) days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Owner's written permission.

C. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for drilled piers.
2. The geotechnical report is referenced elsewhere in the Project Manual.

D. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.

1. Record and maintain information pertinent to each drilled pier and cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Refer Section 03 20 00.

2.2 CONCRETE MATERIALS

A. Refer Section 03 30 00 and Structural General Notes.

2.3 STEEL CASINGS

A. Steel Pipe Casings: ASTM A 283, Grade C, or ASTM A 36, carbon-steel plate, with joints full-penetration welded according to AWS D1.1.

2.4 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 limits as if concrete were exposed to deicing chemicals.

C. Proportion normal-weight concrete mixture as follows:

1. As indicated in Structural General Notes.

2.5 FABRICATING REINFORCEMENT

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

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

3.2 EXCAVATION

A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.

1. Obstructions: Unclassified excavation may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. No changes in the Contract Sum or the Contract Time will be authorized for removal of obstructions.
2. Obstructions: Unclassified excavated materials may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. Payment for removing obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work will be according to Contract provisions for changes in the Work.

B. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.

C. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.

1. Excavate bottom of drilled piers to level plane within 1:12 tolerance.
2. Remove water from excavated shafts before concreting.

D. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect.

1. Do not excavate shafts deeper than elevations indicated unless approved by Architect.
2. Payment for additional authorized excavation will be according to Contract provisions for changes in the Work.

E. Excavate shafts for closely spaced drilled piers and for drilled piers occurring in fragile or sand strata only after adjacent drilled piers are filled with concrete and allowed to set.

F. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.

1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete.

G. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.

1. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit design and construction proposals to Architect for review before proceeding.

3.3 STEEL REINFORCEMENT

A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.

C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.

D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover over reinforcement.

E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.

F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.4 CONCRETE PLACEMENT

A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by Owner's independent testing and inspecting agency.

1. Construct a construction joint if concrete placement is delayed more than one hour. Level top surface of concrete. Before placing remainder of concrete, clean surface laitance, roughen, and slush concrete with commercial bonding agent or with sand-cement grout mixed at ratio of 1:1.

B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.

1. Where concrete cannot be directed down shaft without striking reinforcement, place concrete with chutes, tremies, or pumps.
2. Vibrate top 60 inches of concrete.

C. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing.

1. Vibrate top 60 inches of concrete after withdrawal of temporary casing.

D. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.

E. Protect concrete work, according to ACI 301, from frost, freezing, or low temperatures that could cause physical damage or reduced strength.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.

F. If hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no more than 90 deg F.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Drilled piers.
2. Excavation.
3. Concrete.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.

1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities will be determined by testing and inspecting agency. Final evaluations and approval of data will be determined by Architect.

D. Concrete Tests and Inspections: ASTM C 172 except modified for slump to comply with ASTM C 94.

1. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no fewer than one test for each concrete load.
2. Concrete Temperature: ASTM C 1064; 1 test hourly when air temperature is 40 deg F and below and 80 deg F and above, and 1 test for each set of compressive-strength specimens.
3. Compression Test Specimens: ASTM C 31; one set of four standard 6-inch x 12-inch cylinders for each compressive-strength test unless otherwise indicated. Mold and store cylinders for laboratory-cured test specimens unless field-cured test specimens are required.
4. Compressive-Strength Tests: ASTM C 39; one set for each drilled pier but not more than one set for each truck load. One specimen will be tested at 7 days, 2 specimens will be tested at 28 days, and 1 specimen will be retained in reserve for later testing if required.
5. If frequency of testing will provide fewer than five strength tests for a given class of concrete, testing will be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
6. If strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
8. Report test results in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. List Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests in reports of compressive-strength tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency will make additional tests of concrete if test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by Architect.
    a. Continuous coring of drilled piers may be required, at Contractor's expense, if temporary casings have not been withdrawn within specified time limits or if observations of placement operations indicate deficient concrete quality, presence of voids, segregation, or other possible defects.
11. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. An excavation, concrete, or a drilled pier will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports for each drilled pier as follows:

1. Actual top and bottom elevations.
2. Actual drilled-pier diameter at top and bottom.
3. Top of rock elevation.
4. Description of soil materials.
5. Description, location, and dimensions of obstructions.
6. Final top centerline location and deviations from requirements.
7. Variation of shaft from plumb.
8. Shaft excavating method.
9. Design and tested bearing capacity of bottom.
10. Levelness of bottom and adequacy of cleanout.
11. Ground-water conditions and water-infiltration rate, depth, and pumping.
12. Description, purpose, length, wall thickness, diameter, tip, and top and bottom elevations of temporary or permanent casings. Include anchorage and sealing methods used and condition and weather tightness of splices if any.
13. Description of soil or water movement, sidewall stability, loss of ground, and means of control.
14. Date and time of starting and completing excavation.
15. Inspection report.
16. Condition of reinforcing steel and splices.
17. Position of reinforcing steel.
18. Concrete placing method, including elevation of consolidation and delays.
19. Elevation of concrete during removal of casings.
20. Locations of construction joints.
21. Concrete volume.
22. Concrete testing results.
23. Remarks, unusual conditions encountered, and deviations from requirements.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 63 29

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cold-formed metal framing for the following applications:

1. Exterior non-load-bearing wall framing.
2. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Sealed by the Professional Engineer responsible for their creation and registered in the State of Texas.

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
3. Shop drawings shall be fully coordinated with supporting structural steel and masonry construction, and with curtain wall, storefront, window, and door elements supported by the cold formed metal framing.

1.4 INFORMATIONAL SUBMITTALS

A. Structural Calculations: For information only; calculations sealed by the Professional Engineer responsible for their creation and registered in the State of Texas, indicating compliance with specified performance requirements.

B. Qualification Data: For testing agency.

C. Welding certificates.

D. Product Certificates: For each type of code-compliance certification for studs and tracks.

E. Product Test Reports: For each listed product, from a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Mechanical fasteners.
4. Vertical deflection clips.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide products by one of the following:

1. CEMCO, www.cemcosteel.com.
2. ClarkDietrich Metal Framing; www.clarkdietrich.com.
3. MarinoWare; www.marinoware.com.
4. SCAFCO Corporation; www.scafco.com.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings.
2. Design exterior non-load-bearing wall framing to withstand design loads without horizontal deflections greater than 1/600 for walls with masonry, stone, or plaster finishes, and 1/360 for walls with other finishes.
3. Design interior non-load-bearing wall framing to withstand a horizontal load of 5 lbs/sq ft without deflections greater than l/240 for walls with gypsum board finishes, and l/360 for walls with tile, stone, or plaster finishes.

4. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

5. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
   a. Upward and downward movement of l/300.

6. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Wall Studs: AISI S211.
2. Headers: AISI S212.
3. Lateral Design: AISI S213.

D. Fire-Resistance Ratings: Where metal framing is a part of a fire rated assembly, comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003, Structural Grade, Type H, metallic coated, Grade ST33H; or ASTM A653, Grade 33, unless higher grade is required to meet performance requirements.

1. Coating: G90.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (16 gage), unless greater thickness is required to meet performance criteria.
2. Flange Width: 1-5/8 inches

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips as required to meet design conditions, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (16 gage).
2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.

2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch (20 gage).
2. Flange Width: 1-3/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch (20 gage).
2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.

2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from same type, grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. End clips.
5. Gusset plates.
6. Stud kickers and knee braces.
7. Hole-reinforcing plates.
8. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36, zinc coated by hot-dip process according to ASTM A123.

B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC193 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
3. Material for Exterior Locations: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

C. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

D. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780, MIL-P-21035B or SSPC-Paint 20.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

B. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed steel framing members by welding or screw fastening. Wire tying of framing members is not permitted.
   a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

C. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

D. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

E. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

F. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

G. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as indicated on Shop Drawings, but not greater than 16 inches oc.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Connect vertical deflection clips to bypassing and infill studs and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Unless indicated otherwise on Shop Drawings, install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings, but not greater than 16 inches oc.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.

E. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track.

F. Install horizontal bridging where indicated on Drawings

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 ERECTION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 071326 - SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sheet waterproofing for below-grade horizontal and vertical concrete surfaces, including elevator pits.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

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

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

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

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

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

1. 8-by-8-inch square of waterproofing and flashing sheet.
2. 4-by-4-inch square of drainage panel.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.

1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatment, corner treatment, and protection.
   a. Size: 100 sq. ft. in area.
   b. Description: Each type of wall installation.

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

1.6 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

A. Installer's Warranty: Installer's labor and material warranty in which installer agrees to provide replacement waterproofing material and labor to repair installed product for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

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

B. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain all waterproofing materials from single source from single manufacturer.

2.2 SHEET WATERPROOFING SYSTEMS

A. Products: Complete waterproofing system consisting of composite sheet membranes for horizontal and vertical applications, with drainage panels and associated auxiliary materials. Select one of the following systems for incorporation into the Work:

1. Manufacturer: GCP Applied Technologies Inc.
   a. Horizontal Membrane: Preprufe 300R Plus.
   b. Vertical Membrane:
      1) Self-Adhering: Bituthene 4000, or
      2) Blindside: Preprufe 160R Plus.
   c. Drainage Panel: Hydroduct 220.

2. Manufacturer: Soprema
   a. Horizontal Membrane: Colphene BSW H.
   b. Vertical Membrane:
      1) Self-Adhering: Colphene 3000, or
      2) Blindside: Colphene BSW V.
   c. Drainage Panel: Sopradrain.

2.3 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.

E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.

F. Metal Termination Bars: Stainless steel bars, approximately 1 wide, predrilled at 9-inch centers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.

1. For self-adhering-type vertical membrane:
   a. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
   b. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

2. Verify that compacted subgrade and formwork to receive blindside waterproofing is dry, smooth, sound, and ready to receive waterproofing sheet.

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

3.2 APPLICATION - BLINDSIDE SHEET

A. Install bonded blindside sheet waterproofing according to manufacturer's written instructions.

B. Place and secure drainage panels over substrate. Lap edges and ends of geotextile to maintain continuity.

C. Vertical Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation. Mechanically fasten to substrate.

1. Securely fasten top termination of membrane with continuous metal termination bar anchored into substrate and cover with detailing tape.

D. Horizontal Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation.

E. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.

F. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.

G. Install sheet-waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing. Lap vertical membrane over horizontal membrane that has been turned up at edge of footings and slab to provide continuous drainage plane. Seal in accordance with manufacturer’s instructions.

H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.

3.3 SURFACE PREPARATION - SELF-ADHERING SHEET

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

D. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/8 inch.

E. Bridge and cover isolation joints, expansion joints, discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.

1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

F. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
   a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.

G. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.4 APPLICATION - SELF-ADHERING SHEET

A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

D. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

E. Seal edges of sheet-waterproofing terminations with mastic.

F. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.

G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

H. Immediately install drainage panels with butted joints over waterproofing membrane.

1. Place and secure drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed drainage panels during subsequent construction.

3.5 FIELD QUALITY CONTROL

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

B. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
2. Flood each area for 24 hours.
3. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.

C. Owner will engage an independent testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.

D. Prepare test and inspection reports.

3.6 PROTECTION, REPAIR, AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 071413 - HOT FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rubberized-asphalt waterproofing membrane, reinforced.

B. Related Requirements:

1. Section 071326 "Sheet Waterproofing" for below grade waterproofing.
2. Section 072726 “Air Barriers” for interface with air barrier system.
3. Section 093000 "Tiling" for fluid-applied waterproof membrane beneath tile pavers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

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

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

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

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

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

B. Mockups: Install waterproofing to 100 sq. ft. of deck to demonstrate surface preparation, crack and joint treatment, corner treatment, thickness, texture, and execution quality.

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

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer.

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

C. Protect stored materials from direct sunlight.

1.7 FIELD CONDITIONS

A. Weather Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, or when temperature is below zero deg F.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.8 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Twenty years from date of Substantial Completion.

B. Installer's Special Warranty: Installer’s labor and material warranty in which installer agrees to provide replacement waterproofing material and labor to repair installed product that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.
2. Warranty includes removing and reinstalling construction required to expose and correct waterproofing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain waterproofing materials from single source from single manufacturer.

2.2 WATERPROOFING MEMBRANE

A. Hot Fluid-Applied, Rubberized-Asphalt Waterproofing Membrane: Single component; 100 percent solids; hot fluid-applied rubberized asphalt, reinforced.

1. Basis-of-Design: Subject to compliance with requirements, provide Monolithic Membrane 6125 by American Hydrotech, Inc.; www.hydrotechusa.com, or comparable product by one of the following:
   a. Henry Company.
   b. Tremco.

2.3 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with waterproofing.

B. Surface Conditioner: Manufacturer’s surface conditioner/primer for concrete surfaces.

C. Elastomeric Sheet: 60-mil- minimum, uncured sheet neoprene with manufacturer's recommended contact adhesives as follows:

1. Tensile Strength: 1400 psi minimum; ASTM D 412, Die C.
2. Elongation: 300 percent minimum; ASTM D 412.
3. Tear Resistance: 125 psi minimum; ASTM D 624, Die C.
4. Brittleness: Does not break at minus 30 deg F; ASTM D 2137.

D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum termination bars; approximately 1 by 1/8 inch thick; with stainless-steel anchors.

E. Sealants and Accessories: Manufacturer's recommended sealants and accessories.

F. Reinforcing Fabric: Manufacturer's recommended, spun-bonded polyester fabric.

G. Liquid Flashing: Manufacturer’s two-component, fluid-applied resin membrane flashing system.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

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

3.2 PREPARATION

A. Clean and prepare substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

D. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, and other voids.

3.3 DETAILING AND FLASHING

A. Apply surface conditioner, at manufacturer's recommended rate, over the concrete substrate and allow it to dry.

B. Treat joints, cracks, deck drains, corners, and penetrations according to manufacturer's written instructions.

1. Rout and fill joints and cracks in substrate. Before filling, remove dust and dirt according to ASTM D 4258.
2. Embed strip of reinforcing fabric into a layer of hot rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches on each side of nonmoving joints and cracks not exceeding 1/8 inch thick, and beyond roof drains and penetrations.
    a. Apply second layer of hot fluid-applied, rubberized asphalt over reinforcing fabric.

C. Install elastomeric sheets at terminations of waterproofing membrane according to manufacturer's written instructions.

D. Install termination bars and mechanically fasten to top of elastomeric flashing sheet at terminations and perimeter of waterproofing.

3.4 MEMBRANE APPLICATION

A. Heat and apply rubberized asphalt according to manufacturer's written instructions.

1. Heat rubberized asphalt in an oil- or air-jacketed melter with mechanical agitator specifically designed for heating rubberized asphalt.

B. Start application with manufacturer's authorized representative present.

C. Reinforced Membrane: Apply hot rubberized asphalt to substrates and adjoining surfaces indicated. Spread to a thickness of 90 mils; embed reinforcing fabric, overlapping sheets 2 inches; spread another 125-mil- thick layer to provide a uniform, reinforced, seamless membrane 215 mils thick.

D. Apply waterproofing over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.

E. Embed protection course with overlapped joints into top of waterproofing membrane.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to inspect substrate conditions, surface preparation, waterproofing application, protection, and drainage components, and to furnish reports to Architect.

1. Electric Field Vector Mapping (EFVM): Testing agency shall survey entire waterproofing area for potential leaks using EFVM.

3.6 CLEANING AND PROTECTION

A. Protect waterproofing from damage and wear during remainder of construction period. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071413

SECTION 072726 - AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Fluid-applied, vapor-permeable membrane air barriers.
2. High-temperature vapor retarder sheet membrane.

B. Related Requirements:

1. Section 042100 “Architectural Unit Masonry” for masonry tie-in to adjacent construction systems.
2. Section 061600 "Sheathing" for wall sheathing materials receiving air barrier and joint treatment.
3. Section 072100 “Thermal Insulation” for installation of rain screen insulation over air barrier membrane.
4. Section 075413 “Thermoplastic Membrane Roofing” for air barrier interface with roof membrane.
5. Section 076200 “Sheet Metal Flashing and Trim” for sheet metal flashings required for complete watertight envelope assembly.
6. Section 079200 “Joint Sealants” for joint-sealant materials and installation.

1.2 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

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

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
2. Identify all materials and accessories required for complete watertight installation to be approved by weather barrier manufacturer as complete system and warranted as such.

B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
2. Include details of interfaces with other materials that adjoin the air barrier.

C. Manufacturer’s Certification: Provide letter indicating that selected air barrier products are compatible with the selected wall sheathing, and that coverage rates and substrate preparation steps have been adjusted, if necessary, to reflect the particular absorption rate of the selected sheathing.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

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

D. Manufacturer’s Warranty: Provide a copy of air barrier manufacturer’s 10 year standard warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer with a minimum of 10 successful years documented experience with similar products, and capable of meeting requirements for single-source responsibility.

B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.

1. Build integrated mockups of exterior wall assembly, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
    a. Coordinate construction of mockups to permit inspection by Owner's testing agency of air barrier before external insulation and cladding are installed.
    b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
    c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

B. 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. Adhesion Testing: Mockups will be tested for minimum air-barrier adhesion of 30 lbf/sq. in. according to ASTM D 4541.
2. Membrane Thickness Testing: Mockups will be tested for minimum wet and dry mil thicknesses to verify the installation meets manufacturer's requirements.
3. Notify Architect seven days in advance of the dates and times when mockups will be tested.

1.8 DELIVERY, STORAGE, AND HANDLING

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

B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

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

2.2 PERFORMANCE REQUIREMENTS

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

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 283, ASTM E 783 or ASTM E 2357.

2.3 VAPOR-PERMEABLE MEMBRANE AIR-BARRIER

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

B. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Elastomeric, synthetic polymer or acrylic membrane.

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. Synthetic Polymer Membrane:
      1) Carlisle Coatings & Waterproofing Inc.; Fire Resist Barritech VP.
      2) GCP Applied Technologies; Perm-A-Barrier VPL.
      3) Henry Company; Air-Bloc 31 or 33.

2. Physical and Performance Properties:
   a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
   b. Vapor Permeance: Minimum 10 perms to 25 perms maximum; ASTM E 96/E 96M.
   c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
   d. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for minimum of 9 months weather exposure.
   e. Adhesion to Glass Mat Faced Sheathing: Sufficient to ensure failure due to delamination of sheathing.

2.4 HIGH-TEMPERATURE VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

A. High Temperature Vapor Retarder Sheet: Rubberized asphalt bonded to polyethylene sheet, self-adhesive, complying with ASTM D1970.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. CCW-705 HT High-Temperature-Resistant Air & Vapor Barrier as manufactured by Carlisle Coatings and Waterproofing: www.carlisle-ccw.com.
   b. Ice and Water Sheild HT as manufactured by GCP Applied Techologies: www.gcpat.com.
   c. PE200HT Blueskin High Temperature Roof Underlayment as manufactured by Henry Company: www.henry.com.

2. Application: Behind prefinished metal wall panels over substrate.
3. Thickness: 40 mil (0.040 inch), nominal.
4. Width: 36 inches.
5. Maximum Temperature: 240 deg F
6. Water Vapor Permeance: 0.05 perm, maximum, when tested in accordance with ASTM E96/E96M (Water Method).
7. Single source with air barrier products.

2.5 ACCESSORY MATERIALS

A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.

B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

C. Counterflashing Strip: Modified bituminous, 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil- thick, cross-laminated polyethylene film with release liner backing.

D. Butyl Strip: Vapor retarding, 30 to 40 mils thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing.

E. Modified Bituminous Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.

F. Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.

G. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

H. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

I. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0250 inch thick, and Series 300 stainless-steel fasteners.

J. Modified Bituminous Transition Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.

K. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 "Joint Sealants."

L. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.

3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
4. Verify that masonry joints are flush and completely filled with mortar.

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

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

H. Cover exposed core of sheathing with liquid membrane or manufacturer’s recommended sealant. Fill fastener head divots and holes in sheathing with the air barrier manufacturer’s recommended liquid membrane sealant or air barrier material prior to application of air barrier.

3.3 JOINT TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.

1. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.

B. Exterior Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and apply silicone sealant between joints. Apply sealant and tape joints according to air-barrier manufacturer's written instructions and Section 061600. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.

3.4 TRANSITION STRIP INSTALLATION

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

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install compatible modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate. Shingle-lap air barrier components to the greatest extent possible.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

E. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Seal joints between frames of windows, curtain walls, storefronts, doors, and other items penetrating the air-barrier membrane with elastomeric sealant in accordance with the air barrier manufacturer’s requirements and Section 079200 “Joint Sealants.” Apply sealant in two layers, forming primary and secondary seals.

G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

H. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, modified bituminous strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.5 FLUID AIR-BARRIER MEMBRANE INSTALLATION

A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions.

Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.

1. Apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.

1. Vapor-Permeable Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40-mil dry film thickness, applied in two equal coats.

C. Apply strip and transition strip a minimum of 1 inch onto cured air-barrier material or strip and transition strip over cured air-barrier material overlapping 3 inches onto each surface according to air-barrier manufacturer's written instructions.

D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

F. Apply air barrier to substrate in manufacturer’s instructed wet and dry mil thicknesses.

G. Quality Control: As work progresses, take regular wet mil thickness measurements of applied air barrier membrane. Record results and submit log to Architect for review.

3.6 SELF-ADHERED SHEET MEMBRANE INSTALLATION

A. Install materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.

B. Prepare, treat, and seal inside and outside corners and vertical and horizontal surfaces at terminations and penetrations with termination mastic.

C. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.

D. Apply and firmly adhere air-barrier sheets over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.

1. Apply sheets in a shingled manner to shed water.
2. Roll sheets firmly to enhance adhesion to substrate.

E. Apply continuous air-barrier sheets over accessory strips bridging substrate cracks, construction, and contraction joints.

F. CMU: Install air-barrier sheet horizontally against the CMU beginning at base of wall. Align top edge of air-barrier sheet immediately below protruding masonry ties or joint reinforcement or ties, and firmly adhere in place.

1. Overlap horizontally adjacent sheets a minimum of 2 inches (50 mm) and roll seams.
2. Apply overlapping sheets with bottom edge slit to fit around masonry reinforcing or ties. Roll firmly into place.
3. Seal around masonry reinforcing or ties and penetrations with termination mastic.
4. Continue the sheet into all openings in the wall, such as doors and windows, and terminate at points to maintain an airtight barrier that is not visible from interior.

G. Seal top of through-wall flashings to air-barrier sheet with an additional 6-inch- wide, transition strip.

H. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

I. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.

1. Coordinate air-barrier installation with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.

J. Connect and seal exterior wall air-barrier sheet continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

K. At end of each working day, seal top edge of air-barrier material to substrate with termination mastic.

L. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

M. Seal joints between frames of windows, curtain walls, storefronts, doors, and other items penetrating the air-barrier membrane with elastomeric sealant in accordance with the air barrier manufacturer’s requirements and Section 079200 “Joint Sealants.” Apply sealant in two layers, forming primary and secondary seals.

N. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches (150 mm) beyond repaired areas in all directions.

O. Do not cover air barrier until it has been tested and inspected by testing agency.

P. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of air-barrier system has been provided.
3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed, if applicable.
7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.
9. Strips and transition strips have been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

C. Tests: As determined by Owner's testing agency from among the following tests:
1. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion of 30 lbf/sq. in. according to ASTM D 4541 for each 600 sq. ft. of installed air barrier or part thereof.
2. Membrane Thickness Testing: Provide wet and dry mil testing to verify the installation meets manufacturer’s requirements.

D. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

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

3.8 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from overexposure to UV light and harmful weather conditions as instructed by manufacturer. Do not exceed manufacturer’s time limits for exposure. If exposure limits are exceeded, repair or replace overexposed membrane as directed by manufacturer.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION

SECTION 074213.19 - INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Foamed-insulation-core metal wall panels.

B. Related Requirements:

1. Section 074213.13 “Formed Metal Wall Panels” for perforated metal wall panel rain screen installed over insulated metal wall panels.
2. Section 074293 "Soffit Panels" for metal panels used in horizontal soffit applications.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal panel assembly during and after installation.
8. Review procedures for repair of metal panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

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

C. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

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

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Performance Mockup: Build mockup to set quality standards for fabrication and installation.

1. Build mockup of typical metal panel assembly, including corner, supports, attachments, and accessories. Mockup shall be of size necessary to conduct required tests.
2. Water-Spray Test: Conduct water-spray test of metal panel assembly mockup, testing for water penetration according to AAMA 501.2.
3. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockup unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Integrated Mockups: Include insulated metal wall panels in preliminary and final integrated mock-ups specified in Section 014000 Quality Requirements.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

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

1.9 COORDINATION

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

1.10 WARRANTY

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

1. Failures include, but are not limited to, the following:
   a. Structural failures including rupturing, cracking, or puncturing.
   b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Insulated Metal Wall Panels: Metal wall backup panel installation consisting of foamed-insulation-core metal-skinned wall panels and accessories, attached to metal framing with specified clips or rails, serving as combined thermal, air, and moisture barrier and support for formed metal wall panels specified in Section 074213.13.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E72:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics, as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E119.
2. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which wall panel is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
3. Radiant Heat Exposure: No ignition when tested according to NFPA 268.
4. Potential Heat: Acceptable level when tested according to NFPA 259.
5. Surface-Burning Characteristics: Provide wall panels with a flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E84.

2.3 FOAMED-INSULATION-CORE METAL WALL PANELS

A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.

1. Insulation Core: Modified isocyanurate or polyurethane foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
   a. Closed-Cell Content: 90 percent when tested according to ASTM D6226.
   b. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D1622.
   c. Compressive Strength: Minimum 15 psiwhen tested according to ASTM D1621.
   d. Shear Strength: 26 psi when tested according to ASTM C273/C273M.

B. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.

1. Basis of Design: MetalWrap.MR-300 System as manufactured by Centria, or comparable product by an alternate manufacturer.
2. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality.
   a. Nominal Thickness: 0.025inch (24 gage).
   b. Exterior Finish: Manufacturer's epoxy primer.
   c. Interior Finish: Manufacturer's epoxy primer.
3. Panel Coverage: 36 inches nominal.
4. Panel Thickness: 3.0 inches.
5. Thermal-Resistance Value (R-Value): R-21 according to ASTM C1363.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

3.2 PREPARATION

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

3.3 INSULATED METAL WALL PANEL INSTALLATION

A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.

1. Fasten foamed-insulation-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
2. Apply panels and associated items true to line for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.

B. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.

1. Install clips to supports with self-tapping fasteners.

C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

D. Metal wall panels will be considered defective if they do not pass test and inspections.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

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

END OF SECTION 074213.19

SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes

1. Glazed aluminum curtain walls.
2. Aluminum entrance doors installed within curtain wall assemblies.
3. Bullet resistant curtain walls and entrance doors.

B. Related Sections:

1. Section 072726 “Air Barriers” for perimeter air and vapor seal between glazing system and adjacent construction.
2. Section 079200 “Joint Sealants” for perimeter sealant and back-up materials.
3. Section 088000 “Glazing” for glass and glazing installation.
4. Section 088856 “Ballistics-Resistant Glazing” for bullet-resistant glass.

1.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of manufacturer's standard glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum curtain walls shall withstand movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
   a. Thermal stresses transferring to building structure.
   b. Glass breakage.
   c. Noise or vibration created by wind and thermal and structural movements.
   d. Loosening or weakening of fasteners, attachments, and other components.
   e. Failure of operating units.

B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Loads:

1. Wind Loads: Provide curtain wall systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers ASCE 7 "Minimum Design Loads for Buildings and Other Structures" 6.4.2, "Analytical Procedure", whichever is more stringent, using the factors indicated on the Drawings.

D. Structural-Test Performance: Test according to ASTM E 330 as follows:

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

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

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch, whichever is smaller.
   a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to two times the length of cantilevered member, divided by 175.

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

1. Fixed Framing and Glass Area:
   a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbs/sq. ft.

G. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbs/sq. ft.

H. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 12 lbf/sq. ft.

1. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.

I. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
2. Test Interior Ambient-Air Temperature: 75 deg F.
3. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

J. Interstory Drift: Accommodate design displacement of adjacent stories indicated.

1. Test Performance: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.

K. Energy Performance: Glazed aluminum curtain walls shall have certified and labeled energy performance ratings in accordance with NFRC.

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.
3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
4. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 55 as determined according to NFRC 500.

L. Ballistics Resistance: Indicated curtain walls and entrance doors listed and labeled as Level 3 when tested according to UL 752.

M. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
   a. Joinery, including concealed welds.
   b. Anchorage.
   c. Expansion provisions.
   d. Glazing.
   e. Flashing and drainage.

3. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

4. Indicate location of each door type, component dimensions and field verified openings. Continue the door numbering system established in the Architectural Drawings.
5. Include laboratory mockup Shop Drawings, prepared by a qualified preconstruction testing agency, showing details of laboratory mockup.
   a. Resubmit Shop Drawings with changes made to glazed aluminum curtain walls to successfully complete preconstruction testing.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

E. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data and shop drawings signed and sealed by the qualified professional engineer responsible for their preparation.

F. Preconstruction Mockup Submittals:

1. Preconstruction Testing Program: Developed specifically for Project.
2. Preconstruction Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.

G. Qualification Data: For qualified Installer and professional engineer.

H. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.
2. Include Computer Analysis / Thermographic diagrams showing compliance with thermal performance requirements.

I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls, indicating compliance with performance requirements.

J. Field quality-control reports.

K. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

L. Warranties: Sample of special warranties.

M. Other Action Submittals:

1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and

related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

1. Provide NFRC-certified glazed aluminum curtain walls with an attached label.

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

1. Build mockup of typical curtain wall construction for field testing.
   a. Field testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
   b. Approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

2. Include glazed aluminum curtain wall in final integrated mock-up specified in Section 014000 Quality Requirements.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents unless Architect specifically approves such deviations in writing.

G. Preinstallation Conference: Conduct conference at Project site.

1. Include the following attendees at a minimum:
   a. Construction Manager,
   b. Superintendent
   c. Subcontractor Foreman
   d. Architect,
   e. Waterproofing Consultant,
   f. Air barrier and flashing subcontractors for tie-in, as appropriate.

2. The following topics will need to be addressed along with normal pre-construction requirements:
   a. Delivery and storage requirements;
   b. Shop mock-up requirements;
   c. Field mock-up requirements;
   d. Factory Quality Control testing;
   e. Field Quality Control testing;
   f. Tie-in to adjacent materials;
   g. Schedule.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 WARRANTY

A. Special Assembly Warranty: Standard form in which manufacturer agrees to repair or replace components of glazed aluminum curtain walls that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.
   b. Noise or vibration created by wind and thermal and structural movements.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   d. Water penetration through fixed glazing and framing areas.
   e. Failure of operating components.
   f. Air penetration through glazing and framing areas.
   g. Adhesive or cohesive sealant failures.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Subject to compliance with requirements, provide curtain wall system manufactured by Kawneer NA, www.kawneer.com, or comparable product by one of the following:

1. Oldcastle Building Envelope: www.oldcastlebe.com
2. US Aluminum: www.usalum.com
3. Schuco International; www.schueco.com.
4. YKK AP America Inc.; www.ykkap.com.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING

A. Basis-of-Design: Kawneer 1600 Wall System 2, 6 inch and 7 1/2 inch depth.

1. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
2. Construction: Thermally improved.
3. Glazing System: Retained mechanically with gaskets and with structural sealant; Refer to Drawings for glazing configurations.
4. Glazing Plane: Front.
5. Finish: High-performance organic finish.
6. Ballistics Resistance: Indicated curtain walls shall be modified as required to meet ballistics resistance requirements specified in “Performance Requirements” article. Refer to Section 088856 “Ballistics-Resistant Glazing” for bullet-resistant glass.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

D. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

E. Vertical Mullions: Furnish vertical mullions with closed backs.

F. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

G. Concealed Framing Sealants: Manufacturer's standard sealants.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's insulated, thermally-broken glazed entrance doors for manual-swing operation.

1. Basis-of-Design: Kawneer 350 Toughline Entrance.
2. Door Construction: 2-inch overall thickness, with minimum 3/16-inch- thick extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
3. Door Type: Medium stile; 3-1/2-inch wide stiles and top rail; 10 inch high bottom rail.
4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
   a. Provide nonremovable glazing stops on outside of door.
5. Finish: Match adjacent framing.
6. Ballistics Resistance: Indicated entrance doors shall be modified as required to meet ballistics resistance requirements specified in “Performance Requirements” article. Refer to Section 088856 “Ballistics-Resistant Glazing” for bullet-resistant glass.

B. Entrance Door Hardware: Hardware is specified in Section 087100 "Door Hardware."

2.5 GLAZING

A. Glazing: As specified in Section 088000 “Glazing”; 1 inch thick insulating, Category II safety glass complying with testing requirements in 16 CFR 1201.

1. Refer to Section 088856 “Ballistics-Resistant Glazing” for bullet-resistant glass.

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As specified in Section 088000 “Glazing.”

D. Structural Glazing Sealants: ASTM C1184, chemically curing silicone formulation that is compatible with system components with which it comes into contact, specifically formulated and tested for use as structural sealant and approved by structural sealant manufacturer for use in curtain wall assembly indicated.

1. Color: Black.

E. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

F. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.6 ACCESSORY MATERIALS

A. Window Stools: Provide manufacturer’s standard window stools where indicated on the Drawings.

B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Secton 079200 "Joint Sealants," silicone type.

C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from the exterior:
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
7. Components curved to indicated radii.

C. Fabricate components that, when assembled, have the following characteristics:

1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

D. Curtain-Wall Framing: Fabricate components for assembly using screw-spline system.

E. Factory-Assembled Frame Units:

1. Rigidly secure non-movement joints.
2. Seal joints watertight unless otherwise indicated.
3. Install glazing to comply with requirements in Division 08 Section "Glazing."

F. Door Frames: Reinforce as required to support loads imposed by door operation and for installing door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. Electrical Wiring: Provide framing receiving electrified hardware with concealed wiring harness and standardized Molex plug connectors on one end to accommodate up to twelve wires.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: Metallic color as selected by Architect from manufacturer’s full line.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure non-movement joints.

5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

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

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

F. Install glazing as specified in Division 08 Section "Glazing."

G. Install dual lines of perimeter joint sealant to produce weathertight installation, typical.

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

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

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
   a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
   b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
   c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 ADJUSTING

A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.

1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of representative areas of glazed aluminum curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.

1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft., of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft.
   a. Perform tests of each framing condition as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.

2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.
   a. Perform tests of each framing condition as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.

C. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 084413

CONSTRUCTION MATERIALS TESTING PLAN

PREPARED FOR

Addison, Texas

Customs and Border Protection Facility
4545 Jimmy Doolittle Drive

Prepared by:

April, 2019

Garver Project No.17081101

Construction Materials Required Tests
Base Bid 1 – Landside

SPEC. NO.	TEST NAME	SAMPLING FREQUENCY	No. Tests	SAMPLING METHOD	TESTING METHOD	TESTING CRITERIA
P-152 Excavation and Embankment						
Plan Quantity: 1,006 CY Typical Lot Size: 1,000 CY Estimated Lots: 3 EA, One Days Production						
P-152	Classification of Soils(USCS)	1/material type Or ***	3	***	ASTM D 2487	P-152-2.2e & P-152-2.6
P-152	Liquid Limit, Plastic Limit, & Plasticity Index	1/material type Or ***	3	***	ASTM D 4318	P-152-2.6
P-152	Lab Compaction Characteristics (Standard)	1/material type Or ***	3	***	ASTM D 698	N/A
P-152	Density of Soil In-Place (Nuclear Method)	8/lot Or ***	24	ASTM D 75	ASTM D 6938	P-152-2.2e & P-152-2.6
P-152	Moisture Content	8/lot Or ***	24	ASTM D 75	ASTM D 6938	P-152-2.2e & P-152-2.6
P-152 Excavation and Embankment (Waterline Installation)						
Plan Quantity: 1,000 CY Typical Lot Size: 1,000 CY Estimated Lots: 5 EA, One Days Production						
P-152	Classification of Soils(USCS)	1/material type Or ***	5	***	ASTM D 2487	P-152-2.2e & P-152-2.6
P-152	Liquid Limit, Plastic Limit, & Plasticity Index	1/material type Or ***	5	***	ASTM D 4318	P-152-2.6
P-152	Lab Compaction Characteristics (Standard)	1/material type Or ***	5	***	ASTM D 698	N/A
P-152	Density of Soil In-Place (Nuclear Method)	8/lot Or ***	40	ASTM D 75	ASTM D 6938	P-152-2.2e & P-152-2.6
P-152	Moisture Content	8/lot Or ***	40	ASTM D 75	ASTM D 6938	P-152-2.2e & P-152-2.6

SPEC. NO.	TEST NAME	SAMPLING FREQUENCY	No. Tests	SAMPLING METHOD	TESTING METHOD	TESTING CRITERIA
P-152 Excavation and Embankment (Sewer Installation)						
Plan Quantity: 1,000 CY Typical Lot Size: 1,000 CY Estimated Lots: 5 EA, One Days Production						
P-152	Classification of Soils(USCS)	1/material type Or ***	5	***	ASTM D 2487	P-152-2.2e & P-152-2.6
P-152	Liquid Limit, Plastic Limit, & Plasticity Index	1/material type Or ***	5	***	ASTM D 4318	P-152-2.6
P-152	Lab Compaction Characteristics (Standard)	1/material type Or ***	5	***	ASTM D 698	N/A
P-152	Density of Soil In-Place (Nuclear Method)	8/lot Or ***	40	ASTM D 75	ASTM D 6938	P-152-2.2e & P-152-2.6
P-152	Moisture Content	8/lot Or ***	40	ASTM D 75	ASTM D 6938	P-152-2.2e & P-152-2.6
NCTCOG 301 Lime-Treated Subgrade (8")						
Plan Quantity: 4,070 SY Typical Lot Size: 2,000 SY Estimated Lots: 2 EA						
NCTCOG 301	Lab Compaction Characteristics (Standard)	1/material type Or ***	1	Tex-112-E	ASTM D 6276	NCTCOG 301.2.1.3
NCTCOG 301	Field Gradations	1/lot	2	N/A	N/A	NCTCOG 301.2.3.5
NCTCOG 301	Density of Soil In-Place	1/lot	2	***	ASTM D 698	NCTCOG 301.2.3.6
NCTCOG 301	Moisture Content	1/lot	2	ASTM D 75	ASTM D 3017	NCTCOG 301.2.3.6
NCTCOG 301	Thickness	1/300 SY	13	***	Random Sampling	
NCTCOG 303 Portland Cement Concrete (8" – Roadway, Class P2)						
Plan Quantity: 3,385 SY Typical Lot Size: 4,000 SY Max. or one day's production Estimated Lots: 6 EA						
NCTCOG 303	Compressive Strength	4 cylinders/lot	24	ASTM C31 and C172	ASTM C31 and C39	NCTCOG 303.8.3
NCTCOG 303	Thickness	2/lot	12	***	Random Sampling	NCTCOG 303.8.2
NCTCOG 303	Slump	4/lot	24	ASTM D 3665 & ***	ASTM C 143	NCTCOG 303.4.4
NCTCOG 303	Air Content	4/lot	24	ASTM D 3665 & ***	ASTM C 231	NCTCOG 303.8.3

SPEC. NO.	TEST NAME	SAMPLING FREQUENCY	No. Tests	SAMPLING METHOD	TESTING METHOD	TESTING CRITERIA
NCTCOG 303 Portland Cement Concrete (Misc. Concrete)						
Plan Quantity: 417 SY Typical Lot Size: 4,000 SY Max. or one day's production Estimated Lots: 2 EA						
NCTCOG 303	Compressive Strength	4 cylinders/lot	8	ASTM C31 and C172	ASTM C31 and C39	NCTCOG 303.8.3
NCTCOG 303	Thickness	2/lot	2		Random Sampling	NCTCOG 303.8.2
NCTCOG 303	Slump	4/lot	8	ASTM D 3665 & ***	ASTM C 143	NCTCOG 303.4.4
NCTCOG 303	Air Content	4/lot	8	ASTM D 3665 & ***	ASTM C 231	NCTCOG 303.8.3

*	For all nuclear testing, two random readings are required for each test sublot.
**	In lieu of testing, the Engineer may accept certified state test results indicating that the material meets specification requirements.
***	"As specified by the Engineer"