PROJECT MANUAL

Regeneron TTCX B17
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TABLE OF CONTENTS

DIVISION 27 - COMMUNICATIONS

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

DIVISION 29 - Reserved

SITE AND INFRASTRUCTURE SUBGROUP

DIVISION 30 - Reserved

DIVISION 31 - EARTHWORK

DIVISION 32 - EXTERIOR IMPROVEMENTS

DIVISION 33 – UTILITIES

DIVISION 34 - TRANSPORTATION - Not Used

DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION - Not Used

DIVISIONS 36 through 39 - Reserved

PROCESS EQUIPMENT SUBGROUP - Not Used

END OF TABLE OF CONTENTS

SECTION 01 45 00 - QUALITY ASSURANCE: STRUCTURAL TESTING AND INSPECTION

PART 1 - GENERAL

1.1 GENERAL

A. Quality assurance is testing and inspection to assist the Owner in evaluating the Contractor's performance and quality control in the fabrication shop and field. It is not a substitute for the testing and inspection which is required as part of the Contractor's quality control program.

B. Cost: Except as specifically noted otherwise, the testing agency for quality assurance shall be engaged and paid by the Owner.

1. The Owner has negotiated inspection services based upon the assumption that all fabrication work shall be performed at one single fabrication shop. Costs associated with work being performed in additional shops will require reimbursement to the Owner.

C. Definitions:

1. See Sections 03 30 00 and 05 1 200.
2. The term “Testing Agency” in this Specification section is defined as an independent testing and inspection service engaged by the Owner for quality assurance testing and inspection of structural construction in accordance with applicable building code provisions and any additional activities listed in the Contract Documents.
3. The term “Geotechnical Engineer” in this Specification section is defined as an independent geotechnical engineering service engaged by the Owner for quality assurance testing and inspection of the actual soil conditions to verify compliance with the geotechnical conditions, recommendations and design values described in the Project Geotechnical Report and used as the basis of design for the most current Contract Documents.

1.2 SCOPE

A. Testing Agency shall provide qualified personnel at the site to test and inspect materials installed by and work performed by the Contractor, for the following structural items as indicated in Part 3 of this Specification section:

1. **Section 03 10 00 Concrete Formwork**
2. **Section 03 20 00 Concrete Reinforcement and Embedded Assemblies**
3. **Section 03 30 00 Cast-In-Place Concrete**
4. **Section 05 12 00 Structural Steel**
5. **Section 05 20 00 Steel Joists**
6. **Section 05 30 00 Steel Deck**
7. **Section 05 40 00 Cold Formed Metal Framing**
8. **Section 31 61 00 Footings**

B. Refer to the drawings for Special Inspections requirements for the Project. The Special Inspections shown on the drawings may contain additional testing and inspection that is not listed in this specification section.

1.3 TESTING AGENCY QUALIFICATIONS

A. Testing Agency shall be an independent agency with the experience and capability to conduct testing, inspection and sampling as indicated in accordance with ASTM E 329.

B. Testing Agency shall be an agency approved by the local building official to perform Special Inspections and other related services as outlined in the governing project Building Code.

C. Testing, inspection, and sampling shall be done in accordance with the applicable ASTM standards.

D. Personnel performing visual inspection and non-destructive testing of welds shall meet the requirements of AWS D1.1 for weld inspectors and shall have current certification as an AWS Certified Welding Inspector.

1.4 TESTING AGENCY RESPONSIBILITIES

A. Provide qualified personnel at the site to test and inspect structural construction as the work progresses using the most current Contract Documents and approved shop drawings.

B. Provide additional testing and inspection as needed due to the following:

1. Work performed contrary to Drawings and Specifications
2. Work performed with improper supervision
3. Work performed without prior notice

C. Report deficiencies to Contractor, Owner, Design Professionals within 24 hours.

D. Rejection: The Testing Agency has the right to reject any material at any time, when it is determined that the material or workmanship does not conform to the Contract Documents and shall immediately notify the Owner, Design Professionals, and Contractor of deficiencies. Failure to detect any defective work or material shall not prevent later rejection when such a defect is discovered nor shall it obligate Design Professionals for final acceptance.

E. Noncompliance Log: Indicate to the Contractor where remedial work must be performed and maintain a current log of work not in compliance with the Contract Documents. This noncompliance log shall be submitted to the Design Professionals and Owner on a weekly basis.

F. Reports: Prepare daily inspection, observation, and/or test reports as required herein and provide an evaluation statement in each report stating whether or not the work conforms to requirements of Specifications and Drawings and shall specifically note deviations from them. The daily reports shall be collected and submitted for record to the Design Professionals and Owner weekly.

G. Certification: Upon completion of work and resolution of remedial items, certify in a letter to the Design Professionals and Owner, that the installation is in accordance with the requirements of the Drawings and Specifications.

1.5 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall have sole responsibility for coordinating their work with the Testing Agency to assure that all test and inspection procedures required by the Contract Documents and Public Agencies are provided. The Contractor shall cooperate fully with the Testing Agency in the performance of their work and shall provide the following:

1. Information as to time and place of starting shop fabrication and field construction/erection, at least one week prior to the beginning of the work.
2. The most up to date construction schedule.
3. At least 24 hours advance notice of work requiring testing and inspection.
4. Access to areas as required for testing and inspection.
5. Site File: At least one copy of the most current Contract Documents and approved shop drawings shall be kept available in the contractor's field office. Drawings not bearing evidence of approval and release for construction by the Design Professionals shall not be kept on the job. Provide drawings for the work to be performed in the shop or field one week prior to the start of work.
6. Representative material samples requested by the Testing Agency for testing, if necessary.
7. Full and ample means of assistance for testing and inspection of material.
8. Facilities for proper storage of material samples as required.
9. Proper facilities, including scaffolding, temporary work platforms, safety equipment etc., for inspection of the work in shop and field.

B. Immediately notify the Owner's Testing Agency and Design Professionals in writing of conditions that will adversely affect the work.

C. Materials and installed work may require testing and retesting at any time during progress of work, as directed by Design Professionals. Tests, including retesting of rejected materials for installed work will be done at Contractor's expense.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. Testing Agency shall provide qualified personnel at site to test and inspect structural construction using the latest Contract Documents and approved submittals as indicated in the following sections.

3.2 CONCRETE FORMWORK

A. Quality Assurance:

1. Prior to placement of reinforcement, inspect formwork for grade, quality of material, absence of foreign matter, and other imperfections that might affect concrete placement and tolerances stated herein.
2. Inspect formwork for shape, location and dimensions of the concrete member being formed.
3. Inspect formwork for compliance with specified tolerances, block outs, camber, shoring ties and seal of form joints.
4. Verify condition of bond surfaces, locations and sizes of all accessories, embedment items, and anchorage for prevention of displacement.
5. Verify proper use/application of form release agents.
6. Verify in-situ concrete strength meets requirements for formwork removal in specification section 03 10 00 prior to removal of shores and formwork from beams and structural slabs.
7. Inspect concrete surfaces immediately after removal of formwork and prior to any patching or repair work.

3.3 CONCRETE REINFORCEMENT AND EMBEDDED ITEMS

A. Quality Assurance:

1. Prior to placement, inspect reinforcement and embeds for grade, quality of material, absence of foreign matter, and for suitable storage.
2. Provide continuous inspection of reinforcement and embedded assemblies during placement and immediately prior to concreting operations for: size, quantity, vertical and horizontal spacing and location, correctness of bends and splices, mechanical splices, clearances, compliance with specified tolerances, security of supports and ties, concrete cover, and absence of foreign matter.
3. Inspect epoxy-coated reinforcement for coating damage and required applied coatings.
4. Provide continuous inspection of adhesive anchors installed in horizontal or upwardly inclined orientations and those marked (CERT) on the latest Drawings.
5. Adhesive anchors shall be proof tested in tension as follows:

    a) Testing Agency shall submit an adhesive anchorage proof testing plan to the SER for review and approval prior to performing the anchor proof testing. The anchorage testing plan shall meet the requirements as specified in this section and indicate which anchors have been selected for testing.
    b) Proof testing shall be performed as a confined tension test in accordance with the guidelines of ASTM E488 and the requirements of ACI 355.4.
    c) Testing shall be performed after the minimum curing period specified by the manufacturer.
    d) 5 percent of each type and size of an adhesive anchor assembly and 100 percent of anchors marked (CERT) shall be proof tested in tension by the Owner’s Testing Agency.
    e) All anchors selected for proof testing shall be production anchors. Sacrificial anchors are not acceptable for inclusion in the proof testing plan unless specifically approved by the SER prior to performance of the testing.

f) The adhesive anchors proof tension loads shall be as specified in the general notes of the structural drawings.
g) Anchors shall have no visible indications of displacement or damage during or after proof load application. Concrete cracking in the vicinity of the anchor after loading shall be considered a failure.
h) If more than 10% of the tested adhesive anchors fail to achieve the specified proof load, 100% of the anchors of the same diameter and type as the failed anchor shall be proof tested, unless otherwise direct in writing by the SER. Immediately notify the SER of all failed proof tests.

6. Mechanical post-installed anchors shall be proof tested as follows:

a) Testing Agency shall submit a mechanical anchorage proof testing plan to the SER for review and approval prior to performing the anchor proof testing. The anchorage testing plan shall meet the requirements as specified in this section and indicate which anchors have been selected for testing.
b) 5 percent of each type and size of mechanical anchor shall be proof tested by the Owner's Testing Agency. The required proof test for the anchors is as follows:
c) For torque-controlled mechanical anchors, a proof torque shall be applied to the anchor using a calibrated torque wrench and the proof torque shall be achieved with no more than one-half turn of the anchor nut.
d) For displacement-controlled mechanical anchors, proof of set is to be achieved by inserting the proper setting tool into the anchor and verifying that full set has been achieved.
e) The required proof torque load for torque-controlled mechanical anchors shall be as specified in the general notes of the structural drawings.
f) All anchors selected for proof testing shall be production anchors. Sacrificial anchors are not acceptable for inclusion in the proof testing plan unless specifically approved by the SER prior to performance of the testing.
g) Concrete cracking in the vicinity of the anchor during or after proof torque load application shall be considered a failure.
h) If more than 10% of the tested mechanical anchors fail to achieve the specified proof torque load or set, 100% of the anchors of the same diameter and type as the failed anchor shall be proof tested, unless otherwise direct in writing by the SER. Immediately notify the SER of all failed proof tests.

7. Periodic inspection for post-installed adhesive and mechanical anchors shall be provided in accordance with the building code except that continuous inspection shall be provided for the conditions identified in section B.4. The inspector shall observe all aspects of the anchor installation and shall, at a minimum, verify the following items:

a) Hole drilling method in accordance with the Manufacturer's Published Installation Instructions (MPII) and these installation requirements.
b) Anchor spacing and edge distance.

c) Hole diameter and depth.
d) Hole cleaning in accordance with the MPII.
e) Anchor element type, material, diameter, and length.
f) For adhesive anchors, adhesive identification and expiration date.
g) For adhesive anchors, adhesive installation in accordance with the MPII.
h) For torque-controlled mechanical anchors, the number of turns required to achieve the anchor set torque per the MPII.

3.4 CAST-IN-PLACE CONCRETE

A. Source Quality Assurance: The Owner's Testing Agency shall conduct concrete quality evaluations for compliance with Specifications as follows:

a) Review and test Contractor's proposed materials.
b) Review and test Contractor's proposed concrete mix designs.
c) Confirm production samples at plants or stockpiles are consistent with approved mix designs. Additionally confirm the following:

i. Test for free water in aggregate
ii. Confirm supplier's documentation of compliance with ASTM standards for mix components
iii. Aggregates are from a single source throughout the project for exposed concrete
iv. The same brand of Portland Cement is from a single source

d) Check batching and mixing operations to extent deemed necessary to assure compliance with ASTM C94

B. Quality Assurance:

1. Monitor concrete placement as follows:

a) Verify use of required design mix
b) Record location of point of concrete discharge of each batch truck tested, cross referenced to grid lines.
c) Record temperature of concrete at time of placement.
d) Record weather conditions at time of placement, including temperature, wind speed, relative humidity, and precipitation.
e) Record types and amounts of admixtures added to concrete at the project site.
f) Record amount of water added at the site and verify that total water content does not exceed amount specified in the mix design. Addition of water at the site is subject to prior approval by the Design Professional.
g) Monitor consistency and uniformity of concrete.
h) Monitor preparation for concreting operations, placement of concrete, and subsequent curing period for conformance with Specifications for following procedures:

i. Concrete curing.
ii. Hot weather concreting operations.

iii. Cold weather concreting operations.

2. Conduct tests of concrete as follows and in accordance with ASTM C 1077:

a) Testing frequency: Sample sets for all tests listed below of each concrete design mix placed each day shall be taken not less than once a day, nor less than once for each 100 cubic yards. (75 cubic meters) of concrete, nor less than once for each 5000 square feet (500 square meters) of surface area for slabs or walls. Additional tests shall be performed if deemed necessary by the Owner's Testing Agency and Design Professionals. In addition, sample each truckload used for columns, regardless of other frequencies listed above.

b) Obtain each test sample from different batches selected on a strictly random basis before commencement of concrete placement. Record location in structure of sampled concrete.

c) Determine air content of normalweight concrete in accordance with either ASTM C 231 or ASTM C 138. Determine air content of lightweight concrete in accordance with ASTM C 173. Conduct one test for air content for each strength test required or for every 50 cubic yards (40 cubic meters) of fly ash concrete placed, whichever is less.

d) Determine unit weight of lightweight concrete in accordance with ASTM C 567.

e) Test water content of freshly mixed concrete on a random basis, a minimum of once per 100 cubic yards (75 cubic meters) or every 5000 square feet (500 square meters) of concrete placement, during placement in accordance with AASHTO T 318 for the following concrete types:

i. Hard troweled slabs exposed to view
ii. Slab to receive a bonded finish floor material
iii. Slabs with specified concrete compressive strength exceeding 6000 psi (42MPa)

f) Conduct slump tests in accordance with ASTM C 143.

g) Slump indicated in mix designs shall be achieved at point of placement. Correlation between slump at point of initial discharge from truck and point of placement must be established to determine amount of slump loss which occurs between initial discharge and point of placement. Adjustment may be necessary to achieve slump indicated in mix designs at point of placement.

h) Conduct slump tests for Self Consolidating Concrete (SCC) as follows

i. In accordance with ACI 237, where SCC is used, perform slump flow and visual stability index tests in accordance with ASTM C1611 on the first batch of SCC, and then consecutive batches until two consecutively produced batches are within specification. SCC with a visual stability index value of 2 or 3 shall be stabilized, where possible, with a viscosity modifying admixture or rejected at the discretion of the Engineer and Ready Mix Quality Control Representative. The Ready Mix Producer shall be responsible for adjusting the mix to provide desired flow

and stability. After establishing the consistency of the SCC mix, testing shall continue in accordance with the requirements of the above paragraph.

ii. In accordance with ACI 237, where SCC is used, perform slump flow tests in accordance with ASTM C1621 using a J-ring to determine the passing ability of the SCC mix around reinforcement. If the reinforcing bars retain the coarse aggregates inside the ring, the mixture has a high potential for blocking and should be reproportioned at the direction of the Engineer and Ready Mix Quality Control Representative.

i) Conduct strength tests of concrete as follows:

i. Secure sample sets in accordance with ASTM C 172.

ii. Mold cylinders in accordance with ASTM C 31 and cure under standard moisture and temperature conditions in accordance with ASTM C 31, Section 7 (a). Quantity of cylinders listed below is based on a cylinder size of 4 inch (100mm) diameter x 8 inches (200mm) long. If 6 inch (150mm) diameter by 12 inch (300mm) long cylinders are used, the total quantity of cylinders may be reduced by one with two cylinders instead of three tested at the age designated for determination of f'c.

iii. Test cylinders in accordance with ASTM C 39. For specified concrete strength of 10,000 psi (70MPa) and above, cylinders shall be ground and not capped.

iv. For 28 day mixes mold six cylinders. Test two cylinders at seven days and three cylinders at 28 days. The 28 day strength shall be the average of the three 28 day cylinders. One cylinder shall be retained in reserve for later testing if required.

v. For 56 day mixes mold seven cylinders. Test one cylinder at seven days, two cylinders at 28 days, and three cylinders at 56 days. The 56 day strength shall be the average of the three 56 day cylinders. One cylinder shall be retained in reserve for later testing if required.

vi. For 90 day mixes mold eight cylinders. Test one cylinder at seven days, one at cylinder at 28 days, two cylinders at 56 days, and three cylinders at 90 days. The 90 day strength shall be the average of the three 90 day cylinders. One cylinder shall be retained in reserve for later testing if required.

vii. When high early strength concrete is required by Contractor, additional cylinders shall be made and tested as required at Contractor's expense.

viii. If one cylinder in a test manifests evidence of improper sampling, molding or other damage, discard cylinder and base test results on that of remaining cylinder.

3. Evaluate concrete for conformance with Specifications as follows:

a) Slump:

i. Maintain a slump moving average, comprised of the average of all batches or most recent five (5) batches tested, whichever is fewer.

b) Strength test:

i. Maintain a compressive strength moving average, comprised of three (3) consecutive strength test results, for each mix design used in work.
ii. Strength level of concrete will be considered satisfactory provided averages of all sets of three (3) consecutive strength test results (i.e. moving average) equal or exceed specified 28-day strength, and no individual strength test result falls below specified 28-day strength by more than 500 psi (3.5MPa).
iii. If strength tests fail to meet minimum requirements, concrete represented by such tests shall be considered questionable and shall, if deemed appropriate by the SER, be subject to further evaluation by core testing as specified herein or other testing methods.
iv. Maintain a log that contains the results of all concrete strength tests. The log shall include the results of each test performed, be in electronic spreadsheet format, and updated and submitted along with concrete test data. See example log attached at the end of this Specification Section.

c) Conduct core tests on questionable concrete in accordance with ACI 318 and ASTM C 42.

i. Location of cores shall be coordinated with Design Professionals so as to least impair strength of structure. Before testing cores, discard and replace any that show evidence of having been damaged subsequent to or during removal from structure or which have reinforcement present.
ii. Cores from structure exposed to soil or constant moisture in service (e.g. basement walls, retaining walls, slab-on-grade, piers, footings, etc.) shall be tested in a fully saturated condition. Cores for all other concrete may be tested dry. Prior to commencement of coring, verify with Design Professionals whether cores are to be tested wet or dry.
iii. Fill core holes with low slump concrete or mortar with a strength equal to or greater than that specified for area cored.

d) Concrete in area represented by core test will be considered adequate if average strength of cores is equal to at least 85% of, and if no single core is less than 75% of specified strength.

4. Floor flatness and levelness tolerance compliance testing is to be performed within 72 hours of concrete placement by Testing Agency, and prior to the removal of shores and forms.

a) Testing Agency to test and report flatness (F_F), levelness (F_L) prior to shoring removal. For slabs that include camber, do not test for levelness (F_L). Perform F_F/F_L testing in accordance with ASTM E 1155 requirements.

EXAMPLE CONCRETE STRENGTH SPREADSHEET LOG

PROJECT:
DATE:
ARCHITECT:
STRUCTURAL ENGINEER:

SPECIMEN I.D.	TICKET NUM	PLACEMENT LOCATI	MIX I.D.	CURE TYP	DATE TEST	AGE AT TEST	AVERAGE DIAM	AVERAGE CROSS-	BREAKING LOAD	BREAK TYP	AVERAGE COMPRE
S0002	1234	First Floor	H3651	I, CA	3/8/2106	7	4	12.56	165990	Type 1	13210
						14					
						28					
						56					

*FIELD CURING CONDITIONS: NCB=NO CURING BOX, CB=CURING BOX, I=INSULATED, CO=COOLED, HE=HEATED, CA=CAPPED, IC=ICED, O=OTHER

**BREAK TYPES (AS CLASSIFIED BY ASTM C39):

3.5 CONCRETE MASONRY UNITS

A. Quality Assurance:

1. Testing Requirements:

a) Mortar:

i. Testing Frequency: At the beginning of all masonry work take at least one test sample on three successive working days and at least one week intervals thereafter. Additional samples shall be taken whenever any change in materials or job conditions occur.
ii. Test compressive strength and air content test in conformance with ASTM C780.

b) Grout: The following testing requirements are for grout proportions determined by specified compressive strength only:

i. Testing Frequency: Samples of grout shall be taken for each mix design, each day grout is placed, and not less than every 5,000 square feet (465 square meters) of masonry wall surface area or fraction thereof.
ii. Test compressive strength in conformance with ASTM C1019.
iii. For self-consolidating grout also perform slump flow and Visual Stability Index (VSI) in conformance with ASTM C1611.

c) Compressive strength of masonry (f'm), unit strength method:

i. Testing Frequency: Prior to masonry construction and for every 5,000 square feet (465 square meters) of masonry wall surface area or fraction thereof.
ii. Sample and test units to verify conformance with ASTM C90.
iii. Thickness of bed joints does not exceed 5/8" (15.9 mm)
iv. Verify grout conforms to ASTM C476.

2. Inspection Requirements:

a) Inspect and verify the following items periodically unless otherwise noted as continuous. Periodic inspections shall be random and unannounced and shall occur at least once per week. Where items are noted as continuous, inspections shall be performed whenever and wherever the work is being performed.

i. Compliance with approved submittals
ii. At beginning of CMU construction, verify the following:

(1) Proportions of site-prepared mortar.
(2) Construction of mortar joints.
(3) Location of reinforcement and connectors.
(4) Block unit size.

iii. Prior to grouting, verify the following:

(1) Grout space.
(2) Grade, type, and size of reinforcement and anchor bolts.
(3) Placement of reinforcement and connectors.
(4) Proportions of site-prepared grout.
(5) Construction of mortar joints.
(6) Bond pattern.
(7) Tie-in at intersecting walls.
(8) Condition of block units after placement.
(9) Bond beam and/ or tie beam locations, reinforcement, and lap splice lengths.

iv. During CMU construction, verify the following:

(1) Size and location of structural elements.
(2) Type, size, and location of anchors and/or embedments, including other details of connection of masonry to structural members, frames, or other construction.
(3) Welding of reinforcement (continuously inspect).
(4) Preparation, construction, and protection of masonry during cold weather or hot weather. For cold and hot weather requirements see Section 042200.
(5) Placement of grout (continuously inspect).
(6) Lintel size, location, and bearing lengths.

v. Observe preparation of grout specimens, mortar specimens, and/or prisms.

b) Inspections will also include verification that:

i. Materials are properly stored.
ii. Installation is within specified construction tolerances.
iii. Proper mortar ingredients and mixing techniques are being used.
iv. Mortar time on board is within specified limits.
v. Joints are being properly tooled.
vi. Flashing assembly is being properly fabricated and installed.
vii. Weeps and vents are being installed and are functional.
viii. Control joints are being installed as indicated, or, as specified.

3.6 STRUCTURAL STEEL

A. Quality Assurance:

1. Shop inspection shall include alignment and straightness of members, camber, preparation for connections, dimensional checks, testing of shop bolts, witnessing of welding procedures, testing of cuts, weld access holes and copes of Heavy Sections as defined in this Specification, examination and testing of completed welds, headed studs and deformed bar anchors, cutting of Heavy Sections, finishing of column ends, cleaning, painting and storage of material. All shop

fabrication shall be inspected in the shop. Camber shall be verified in a minimum of 10% of all members requiring camber. If, in the opinion of the SER and Testing Agency this testing discloses a large ratio (10% or more) of unacceptable cambers, the required percentage of tested cambers may be increased by the SER to 100% at no expense to the Owner. Where testing is required for less than 100% of locations, select test locations at random and throughout the project.

2. Field inspection shall include connections, proper tensioning of bolts, levelness, plumbness and alignment of the frame, conformance to AWS welding methods, examination of surface before welding, examination and testing of completed welds, headed studs and deformed bar anchors and field painting, including touch-up. Where testing is required for less than 100% of locations, select test locations at random and throughout the project.
3. Review the following items in the shop and field:

    a) Welding certificates, procedures, and personnel
    b) Stud welding setup and operators; bolting procedure and crew
    c) Bolting procedure and crew
    d) Mill certifications for compliance with the Contract Documents.

4. Inspect high strength bolted construction in accordance with RCSC "Specification for Structural Joints using ASTM A 325 or A 490 Bolts," including but not limited to:

    a) Surface preparation and bolt type conforms to plans and Specifications prior to start of bolting operations.
    b) Proper bolt storage and handling procedures per codes and standards referenced by this Specification are being followed.
    c) Visually inspect all bolted connections.
    d) For all bolted connections that are indicated as snug tight, connections are properly compacted and brought to the snug tight condition progressing outward from the most rigid part.
    e) For all bolted connections that are indicated as pretensioned or slip critical, pre-installation verification testing is performed by the inspector in cooperation with the contractor in accordance with RCSC section 9.2 and section 7.
    f) For all bolted connections that are indicated as pretensioned or slip critical, through routine observation, as defined in RCSC 9.2.1, 9.2.3 or 9.2.4, that the pretensioning methods of RCSC 8.2.1, 8.2.3, or 8.2.4, as appropriate, are performed.

        i. "Routine observation" is defined as observation of 10 bolts for every 100 bolts with a minimum of 2 bolts per connection.

    g) Retest bolted connections that fail initial inspection after correction by the Fabricator or Erector.

5. Test and inspect welding and welded construction including but not limited to:

    a) Review of submittals:

i. Review all Welding Procedures prepared by the Contractor's Engineer or Certified Welding Engineer. Verify the accuracy of all essential variables of the Welding Procedure including but not limited to confirmation that weldability and heat induction for Heavy Sections and high restraint welds comply with AWS requirements.
ii. Review of welding procedures including prequalification, qualifications test and, for Heavy Sections and High Restraint Welds, the welding procedure prepared by the Contractor's Engineer or Welding Consultant
iii. Submit for record a report indicating that the Welding Procedures have been reviewed as indicated above to the Design Professionals.

b) Test all complete joint penetration welds for soundness by means of either radiographic or ultrasonic testing in accordance with AWS D1.1 and ASTM E164 procedures. All flaws in plate or flange material revealed during such tests shall be repaired and retested by the Contractor at the Contractor's expense.
c) Test all partial joint penetration welds for soundness by means of visual and magnetic particle inspection, unless other methods are specified in the Contract Documents. All flaws in plate or flange material revealed during such tests shall be repaired and retested by the Contractor at the Contractor's expense.
d) Testing of welds at Heavy Sections and High Restraint Welds shall be performed not less than 48 hours after the weld has been completed.
e) Visually inspect all fillet welds. In addition test ten percent (10%) of all fillet welds using a non-destructive method, such as dye penetrant or magnetic particle. Select test locations randomly throughout the structure, but test at least one weld in each location with 6 or more welds per connection. If, in the opinion of the SER and Testing Agency this testing discloses a large ratio (10% or more) of unacceptable welds, the required percentage of tested welds may be increased by the SER to 100%, all at the Contractor's expense.
f) Inspection and Testing by the Testing Agency of High Restraint Welds and where Heavy Sections are to be joined by partial or complete joint penetration welds in tension:

i. Joint Preparation: Monitor fit up and joint preparation (bevel angle, etc.) for conformance to the submitted welding procedures including preheat and interpass temperature. Monitor base metal temperature during welding operations.
ii. Test Complete Joint Penetration Welds in accordance to the requirements of this Specification section, ultrasonically in accordance with AWS D1.1 procedures. On T or corner joints, pay careful attention to the heat affected zone and base metal where the weld shrinkage stresses are in the through thickness direction.

iii. Test Partial Joint Penetration Butt Joints in accordance with this Specification section by the magnetic particle method. At T or corner joints, in addition to the magnetic particle testing, ultrasonically scan the heat affected zone and adjacent base metal from face "C" per AWS D1.1 Table 6.7 and Annex Q7 to detect lamellar tears and shall be done with a compression wave. The Testing Agency shall submit a testing procedure that includes evaluation (acceptance criterion) procedures to the Design Professionals for review.

g) At Heavy Sections and High Restraint Welds: provide pre-production sample testing of heat treatment, observe fabrication, welding and heat treatment of the samples for conformance with submitted welding procedures. Establish locations of testing coupons following AWS procedures. Test coupons following AWS procedures to verify satisfactory results using the welding procedure and heat treatment.

6. Visually inspect all headed studs and deformed bar anchors for complete fusion and full 360-degree weld flash (or fillet).

a) Check all studs with incomplete fusion, and at random five studs at each of six beams per floor, by bending to an angle of 15 degrees from its original axis (away from any missing flash). If more than twenty percent of studs fail on one member, check all studs on member. In addition, for each member with any defective studs, test an additional member.
b) Contractor to replace any studs that crack or break. Contractor to only straighten studs that would foul other work or have less than 1 inch (25mm) cover in bent position.

7. Cleaning & Painting:

a) Examine shop painting to verify conformance with this Specification.
b) Examine loading and unloading of steel to visually observe that damage does not occur during shipping and handling.

3.7 STEEL JOISTS

A. Quality Assurance:

1. Review mill certifications for compliance with the Contract Documents.
2. Review welders' qualification to determine compliance to Specifications.
3. Review welding procedures to determine compliance to Specifications.
4. Visually inspect weld quality, size and length
5. Visually inspect paint.
6. Verify that inspections required by manufacturer have been performed, and any corrections required as a result of inspections have been completed.
7. Inspect erected joists for damage.
8. Visually inspect placement of erected steel joists including:

a) Proper seat bearing
b) Welding from seat to support
c) Bolted and welded field connections
d) Bridging installation
e) Spacing

9. Submit inspection reports and state in each report whether or not fabrication and erection conforms to requirements of Specification and Drawings and shall specifically note deviations from them.

B. Joist manufacturer responsibilities:

1. Owner reserves the right to engage Owner's Testing Agency to perform shop inspections at any time during fabrication.
2. Notify Contractor and Testing Agency seven (7) days in advance of start of shop fabrication and three (3) days in advance of initial field delivery.
3. Comply with instructions of Testing Agency to correct deficiencies in materials and welding work as provided in Contract Documents.
4. Make available to Testing Agency lists showing identification marks, number of each different type of joist required, overall length, components size, ASTM designation of materials, camber and shop paint.

3.8 STEEL DECK

A. Quality Assurance:

1. Decking is subject to inspection and testing once connected in place:

a) Expense of removing and replacing any portion of decking for testing purposes will be borne by the Owner if connections are found to be satisfactory.
b) Contractor shall remove work found to be defective and provide acceptable work at no additional cost to the Owner.

2. Field inspect all steel deck after erection for the following:

a) Proper deck profile, type (acoustic, cellular, vented), gage and finish
b) Correct deck orientation, alignment, bearing and laps (if applicable)
c) Supplementary items including secondary supports, closures, pour stops, sumps and their connections to deck and to other members
d) Damage of members during transportation, storage and erection
e) Proper installation and erection
f) Proper deck to supporting member and deck to deck connections (quantity, size, spacing and quality of welds/fasteners) including inspection of deck welding

3. Field inspect headed studs (shear connectors) as follows:

a) At the start of each day's operations for welding headed studs, the Contractor shall first weld a minimum of two studs to demonstrate

proper welding set up for that day's typical deck and support conditions. Testing Agency to observe Contractor hammer-bending the studs to an angle 15 degrees from the vertical without weld failure.

b) Should failure occur in the weld zone of either stud, Contractor shall adjust welding set up and repeat the test until two consecutive studs are, tested and found satisfactory before any production welding of studs may begin.

c) Perform demonstration tests at each significant change in conditions including deck thickness, deck coating (painted to galvanized) or number of deck layers.

d) Do not weld studs through more than one layer of steel deck, except where cellular deck is specified.

e) Failed test studs shall be removed and replaced by production studs.

f) During production installation, bend testing of headed studs is required where incomplete weld flash is observed, and at random locations on each floor. For production testing requirements see Section 051200.

3.9 FOOTINGS

A. Quality Assurance by Geotechnical Engineer (or Testing Agency if the same entity):

1. Review Contractor's proposed footing installation methods, sequences, and procedures.
2. Verify bearing stratum and bearing capacity of each footing; verify levelness of footing end bearing surface.
3. Determine final bearing elevation at each footing location.
4. Observe, record, and report footing as-built plan location, footing size and final elevations of bottom (where possible) and top of completed footings.
5. Coordinate with Testing Agency.

B. Quality Assurance by Testing Agency:

1. Inspection of Batch Plant: As required to ensure that concrete delivered to job complies with Specifications and design mix. Batch plant inspection shall be required once at start of job and thereafter if concrete falls below Specifications.
2. Inspection of Reinforcement: Provide continuous visual inspection of site fabrication. Record the steel reinforcement bar sizes, grade, length, and number of bars.
3. Inspection of Concrete and Reinforcement Placement: Provide continuous visual inspection of installation of reinforcement and concrete placement including verification of laitance removal at top of footings.
4. Check ready mix delivery tickets for correct concrete mix design number. Record batch to placement time. Check slump, temperature, and batch to placement time for each set
5. Slump Tests: ASTM C143. Make one test from each truck.
6. Concrete Compressive Strength Tests: Testing agency will take a minimum of one sample set of concrete cylinders per 20 cubic yards of concrete. See CAST-IN-PLACE CONCRETE section of this specification for requirements. Cure cylinders to simulate same curing conditions as concrete in footings. Reports of cylinder tests shall state footing location(s), laboratory or site curing,

compression strength, type of fracture, age at testing, concrete supplier, mix specification strength, any other pertinent information, test results, and conclusions.

7. Additional Tests: Perform additional testing if, in the opinion of the Design Professionals, concrete of poor quality has been placed based on cylinder strengths below Specification requirements or visual defects. Tests may be compression tests on cored cylinders, ASTM C42, and load tests as outlined in ACI 318, or as directed by the Design Professionals. Complete continuous coring of footings will be required, at Contractor's expense, where verification of quality of concrete is not otherwise attainable.

END OF SECTION

SECTION 03 10 00 - CONCRETE FORMWORK

PART 1 - GENERAL

1.1 GENERAL

Work of this Section shall conform to requirements of Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections.

1.2 SCOPE

Provide all labor, materials, equipment, services and transportation for formwork and related accessories required to complete all cast-in-place concrete work as shown on Drawings, as specified herein, and as required by the job conditions.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Quality Assurance: Structural Testing and Inspection	Section 01 45 00
Concrete Reinforcement and Embedded Assemblies	Section 03 20 00
Cast-In-Place Concrete	Section 03 30 00
Thermal and Moisture Protection	Division 7

1.4 CODES AND STANDARDS

A. Building Code: Concrete work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards:

1. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 237 – Self Consolidating Concrete.
3. ACI 301 –Specifications for Structural Concrete.
4. ACI 318 – Building Code Requirements for Structural Concrete and Commentary.
5. ACI 347 – Guide to Formwork for Concrete.
6. ACI 347.2R – Guide for Shoring/Reshoring of Concrete Multistory Buildings

C. Definitions:

1. See Section 03 30 00.

1.5 CONTRACTOR QUALIFICATIONS

A. The work of this section shall be performed by a company specializing in the type of concrete formwork required for this Project, with a minimum of 10 years of documented successful experience and shall be performed by skilled workers thoroughly experienced in the necessary crafts.

B. Contractor's testing agency Services: Required as specified in Division 1, and herein.

C. Materials and installed work may require testing and retesting at any time during progress of work, as directed by Design Professionals. Tests, including retesting of rejected materials for installed work will be done at Contractor's expense.

1.6 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested.

(1) Submittal Schedule
(2) Shop Drawings
(3) Shoring/Reshoring Calculations
(4) Product Data
(5) Samples
(6) Compatibility Certification
(7) Hazardous Materials Notification

1. Submittal Schedule: See Section 03 30 00.
2. Shop Drawings:

a) Submit for action: Formwork shop drawings sealed and signed by a Professional Engineer licensed in the state where the project is located. Shop drawings shall clearly indicate but not be limited to the following:

1. Size, type and quality of form materials including conditions at tops and ends of walls. (If wood is used, indicate species.)
2. Form construction indicating structural stability and jointing including special form joints or reveals required by Contract Documents
3. Location and pattern of form tie placement, and other items that affect the appearance of concrete that will remain exposed to view.
4. Form finish clearly indicating proper locations and full coordination with concrete finishes required by Contract Documents.
5. Layout, procedures, and sequencing of shoring and reshoring that correlates with the information contained in the shoring/reshoring calculations described below.

6. Locations and dimensions of openings in structural members including floor slab, shear walls, columns and beams. See SUBMITTALS Section of Specification 03 30 00.
7. Location of proposed construction joints in walls, floors, slabs, and beams. See SUBMITTALS Section of Specification 03 30 00.

3. Shoring/Reshoring Calculations: Submit for record. Calculations sealed and signed by a Professional Engineer licensed in the state where the project is located. Calculations shall clearly address but not be limited to the following:

   a) Shoring removal and reshoring installation procedure including timing and sequencing.
   b) Concrete age and strength at the time of each shoring/reshoring operation.
   c) Description of construction loads assumed including concrete, formwork, and construction live load in accordance with ACI 347.
   d) Description of the distribution of construction loads between the shored/reshored levels.
   e) The total construction load imposed on all levels supporting shoring/reshoring at each stage of the shoring/reshoring cycle.
   f) A written statement by the Professional Engineer that the total construction load imposed on any level supporting shoring/reshoring, at all stages of the shoring/reshoring cycle, accounting for concrete age and relative strength at time of loading, meets the requirement of Section 3.2.

4. Product Data: Submit for action copies of manufacturers' product data and installation instructions for proprietary materials used in exposed concrete work, including form liners, release agents, manufactured form systems, ties, and accessories.
5. Samples: At request of Architect, submit for record samples of form ties and spreaders.
6. Compatibility Certification: Submit for record a written statement certifying that form release agent used is compatible with subsequent architectural finish materials applied to concrete surfaces. Submit along with manufacturer's data.
7. Hazardous Materials Notification: Submit for record. In the event no product or material is available that does not contain hazardous materials as determined by the Owner, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

B. Submittal Process: See Section 03 30 00.

C. SER Submittal Review: See Section 03 30 00.

D. Substitution Request: See Section 03 30 00.

E. Request for Information (RFI): See Section 03 30 00.

1.7 FORMWORK DESIGN

A. Design of Formwork, Shoring/Reshoring, and its removal is the Contractor's responsibility.

B. Design, erect, support, brace and maintain formwork so that it will safely support vertical and lateral loads per SEI/ASCE 37-02 that might be applied, until such loads can be supported by the concrete structure.

C. Design Requirements:

1. Forms shall be designed for fabrication and erection in accordance with Design Professionals' requirements and recommendations of ACI 301, 318 and 347.
2. Design formwork in a manner such that the total construction load does not at any time exceed the total design load of new or existing construction and accounts for concrete age and relative strength at time of loading. See Section 3.2 for shoring/reshoring requirements.
3. Design formwork for loads and lateral pressures outlined in Section 2.2, ACI 347, and wind and seismic loads as specified by SEI/ASCE 37-02 unless otherwise controlled by local building code.
4. Design formwork to include loads imposed during construction, including weight of construction equipment, concrete mix, height of concrete drop, rate of filling of formwork, vibrator frequency, ambient temperature, foundation pressures, lateral stability, temporary imbalance or discontinuity of building components, and other factors pertinent to safety of structure during construction.
5. The use of flowing concrete (8" (200mm) to 10" (250mm) slump) or Self-Consolidating Concrete requires a review of the formwork design based on the rate of placement and setting time of the mix. Unless shown to be sufficient otherwise, formwork design shall conform to the requirements of ACI 237.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions and Division 1, including the following:

1. Store forms and form materials clear of ground and protect from damage.

1.9 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

A. See Section 01 45 00.

1.10 QUALITY CONTROL BY CONTRACTOR

A. See Section 03 30 00.

1.11 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

A. See Section 03 30 00.

1.12 PERMITS AND WARRANTY

A. Permits: See Section 03 30 00.

B. Warranty: See Section 03 30 00. Failures include but are not limited to the following:

1. Discoloration of concrete scheduled to remain exposed to view.
2. Damage of concrete finishes caused by forms.
3. Damage of concrete caused by form stripping.
4. Non-compliance with form finishes required for designated architectural finishes.
5. Non-compatibility of form release agent with subsequent architectural finish materials applied to concrete surfaces.
6. Excessive and/or noticeable bowing in placed concrete members caused by deflection of formwork during concrete placement.

PART 2 - PRODUCTS

2.1 FORMWORK REQUIREMENTS

A. General Requirements:

1. Formwork shall meet construction safety regulations for the state where the project is located.
2. Forms shall be removable without impact, shock or damage to concrete surfaces, the structure and adjacent materials.
3. Forms shall be tight-fitting, designed and fabricated for required finishes and to withstand concrete weight and maintain tolerances as specified in ACI 117 for the following designations: (See architectural drawings for locations).

    a) Class A – For surfaces prominently exposed to public view where appearance is of special importance.
    b) Class B – Coarse-textured concrete-formed surfaces intended to receive plaster, stucco or wainscoting.
    c) Class C – General Standard for permanently exposed surfaces where other finishes are not specified.
    d) Class D - Minimum quality surface where roughness is not objectionable, usually applied where surfaces will be concealed.

4. Furnish forms in largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings, using form materials with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.
5. Butt Joints: Shall be solid and complete with backup material to prevent leakage of cement paste.

B. Form Finishes for Exposed Surfaces:

1. Type: Straight, smooth, free of cement paste leaks at butt-joints, surface imperfections and other irregularities detrimental to appearance of finished concrete, fully coordinated with requirements for required finish material.
2. Form exposed areas of columns, beams, ledges, balcony fascias to achieve true alignment and level soffit of edge beams and concrete edges. All such areas must be sharp, straight and true to line and level. Edge beams and concrete canopies and ledges must have adequate shoring to prevent any visible amount of sag and sufficient bracing to prevent any lateral movement during construction.

2.2 FORM MATERIALS

A. General: Plywood, fiberglass, metal, metal-framed plywood faced, or other acceptable panel-type materials.

1. Provide materials with sufficient strength to prevent warping.

B. Plywood: Of species and grade suitable for intended use, sound undamaged sheets with clean true edges, minimum 5/8" (16mm) thick, complying with U.S. Product Standard PS-1.

1. Other Acceptable Sheet Materials: 14 gauge (2.0mm) sheet steel or fibrous glass reinforced resin.

C. Lumber: Construction grade or better consistent with calculation requirements, without loose knots or other defects.

1. Use only where entire width can be covered with one board 11-1/4" (285mm) or less in width.

D. Forms for Cylindrical Columns and Supports: Metal, glass-fiber reinforced plastic, or paper or fiber tubes that will produce smooth surfaces without joint indications.

1. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.

E. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to support weight of placed concrete without deformation.

F. Chamfer for Form Corners:

1. Types: Chamfer strips of wood, metal, PVC or rubber fabricated to produce smooth form lines and tight edge joints, 3/4" (20mm) size, maximum possible lengths.
2. Required for all exposed corners of beam, walls and column forms.

G. Form Ties:

1. Type: Factory-fabricated metal, adjustable length, designed to prevent form deflection and to prevent spalling concrete upon removal.
2. Ties used for architecturally exposed concrete shall be galvanized.

3. Ties shall not leave metal closer than 1-1/2" (40mm) to exposed surface.
4. When removed, ties shall not leave holes larger than 1" (25mm) diameter in concrete surface.
5. Removable Ties: Use type with tapered cones, 1" (25mm) outside diameter, for concrete walls which will remain exposed to view and scheduled for architectural finishes.
6. Snap-Off Ties: Use for concrete walls below grade and walls which will not remain exposed to view and are not scheduled for architectural finishes.
7. Wire Ties: Not acceptable.

H. Nails, Spikes, Lag Bolts, Thru-Bolts, Anchorages:

1. Type: Of size, strength and quality to meet the required quality of formwork.

I. Form Release Agent:

1. Type: Commercial formulation form release agent of non-emulsifiable type which will not bond with, stain, or adversely affect concrete surfaces. Form release agent shall not impair subsequent treatment of concrete surfaces requiring bond or adhesion, or impede the wetting of surfaces to be cured with water or curing compounds. Form release agent shall be compatible with subsequent architectural finish materials applied to concrete surfaces. Apply in compliance with manufacturers' instructions.
2. Form release agent shall meet, at a minimum, all federal and state requirements for volatile organic compounds (VOC's).
3. For Steel Forms: Non-staining rust-preventative type.

J. Reglets: Provide sheet metal reglets formed of same type and gauge as flashing metal, unless indicated otherwise on Drawings. Where resilient or elastomeric sheet flashing, or bituminous membranes are terminated in reglets, provide reglets of not less than 26 gauge (0.55mm) galvanized sheet metal. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

K. Coordinate with materials as specified in Section 03 20 00 Concrete Reinforcement and Embedded Assemblies.

PART 3 - EXECUTION

3.1 FORMWORK

A. General:

1. Inspect areas to receive formwork.
2. Construct forms to sizes, shapes, lines, and dimensions shown on Contract Documents, and to obtain accurate alignment, location, grades, level and plumb work in finished structures.

3. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins, and to maintain alignment.
4. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, drips, bevels, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required in the Work.
5. Comply with shop drawings, ACI 301, 318, 347 and Contract Documents.
6. Maintain formwork and finished work construction tolerances complying with ACI 301 and 117.
7. Provide shore and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof.
8. Erect forms for easy removal without hammering or prying against concrete surfaces.
9. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.
10. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only.
11. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
12. Chamfer exposed corners and edges as indicated on the architectural drawings, using wood, metal, PVC or rubber chamfer strips fabricated to produce smooth lines and tight edge joints.
13. Design, erect, support, brace and maintain formwork and shoring to support loads until such loads can be safely supported by the concrete structure.
14. Where specifically shown on the Contract Documents as monolithic, upturned beams, curbs and similar members in connection with slabs shall be formed so that they can be poured integrally with slabs.

B. Concrete Accessories and Embedded Items:

1. Install into forms concrete accessories, sleeves, inserts, anchor bolts, anchorage devices and other miscellaneous embedded items furnished by other trades or that are required for other work that is attached to or supported by cast-in-place concrete.

    a) Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached.

2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated on drawings or required by other trades.
4. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces.
5. Coordinate with CONCRETE REINFORCEMENT AND EMBEDDED ASSEMBLIES Section in Specification 03 20 00.

6. Install accessories and embedded items straight, level, plumb and secure in place to prevent displacement by concrete placement.

C. Temporary Openings:

1. Locate temporary openings in forms at inconspicuous locations.
2. For clean-outs and inspection before concrete placement, locate temporary openings where interior area of formwork would otherwise be inaccessible.
3. For cleaning and inspections, locate openings at bottom of forms to allow flushing water to drain.
4. Securely brace temporary openings and set tightly in forms to prevent loss of concrete.
5. Close temporary openings with tight fitting panels, flush with inside face of forms, neatly fitted so that joints will not be noticeable on exposed concrete surfaces.

D. Provisions for Other Trades: Coordinate and provide openings in concrete formwork to accommodate work of other trades.

1. Determine size and location of openings, recesses, chases, offsets, openings, depressions, and curbs from information provided by trades requiring such items.
2. Accurately place and securely support items built into forms.

E. Cleaning:

1. Normal Conditions:

a) Thoroughly clean forms and adjacent surfaces to receive concrete.
b) Remove chips, wood, sawdust, dirt, standing water or other debris just before placing concrete.
c) Flush with water or use compressed air to remove remaining foreign matter.
d) Verify that water and debris can drain from forms through clean-out ports.

2. During Cold Weather:

a) Remove ice and snow from within forms.
b) Do not use de-icing salts.
c) Do not use water to clean out completed forms, unless formwork and concrete construction will proceed within heated enclosure.
d) Use compressed air or other means to remove foreign matter.

F. Form Release Agents

1. Before placing reinforcing steel and miscellaneous embedded items, coat contact surfaces of forms with an approved non-residual, low VOC form release agent in accordance with manufacturer's published instructions.

2. Do not allow release agent to accumulate in forms or come into contact with reinforcement or concrete against which fresh concrete will be placed.

    a) Coat steel forms with nonstaining, rust-preventative material.

3. Remove form release agent and residue from reinforcement or surfaces not requiring form coating.

G. Before Placing Concrete:

1. Inspect and check completed formwork, shoring and bracing to ensure that work is in accordance with formwork requirements of this section and Contract Documents, and that supports, fastenings, wedges, ties, and parts are secure.

    a) Make necessary corrections or adjustment to formwork to meet tolerance requirements.

2. Retighten forms and bracing before concrete placement to prevent mortar leaks and maintain proper alignment.
3. Notify Testing Agency sufficiently in advance of placement of concrete to allow inspection of completed and cleaned forms.

H. During Concrete Placement:

1. Maintain a check on formwork to ensure that forms, shoring, ties and other parts of formwork have not been disturbed by concrete placement methods or equipment.
2. Use positive means of adjustment as required for formwork settlement during concrete placing operations.

I. Camber:

1. Provide camber in formwork as required for anticipated deflections due to weight and pressures of fresh concrete and construction loads.
2. Camber bottom forms where indicated on the drawings. Whenever forms are cambered, screeded levels for establishing top of concrete must be cambered to the same amount and to the same profiles such that scheduled depth of member is not reduced by lifting of forms. Check camber and adjust forms before initial set as required to maintain camber.

J. Surface Defects:

1. Install forms that will not impair the texture of the concrete and are compatible with the specified finish type.

K. Formwork Loads on Grade

1. Where loads from formwork bear on grade, provide suitable load-spreading devices for adequate support and to minimize settlement. In no event shall frozen ground or soft ground be utilized directly as the supporting medium.

L. Footings and Grade Beams:

1. Provide forms for footings and grade beams if soil or other conditions are such that earth trench forms are unsuitable.
2. When trench forms are used, provide an additional 1" (25mm) of concrete on each side of the minimum design profiles and dimensions indicated.

M. For slabs-on-grade, secure edge forms in such a manner as to not move under weight of construction loads, construction and finishing equipment, or workers.

3.2 SHORES AND RESHORES

A. Comply with ACI 347.2R for shoring and reshoring in multistory construction, and as specified herein.

1. For non-post tensioned flat plate concrete structures of five supported levels or more, extend shoring/reshoring at least four levels below the floor or roof being placed (shore formwork, reshore three levels below)
2. For non-post tensioned flat plate concrete structures of less than five supported levels, extend shoring/reshoring to ground.
3. For all other concrete structures of four supported levels or more, extend shoring/reshoring at least three levels below the floor or roof being placed (shore formwork, reshore two levels below)
4. For all other concrete structures of less than four supported levels, extend shoring/reshoring to ground.
5. Reshores shall be placed as soon as practicable after stripping operations are complete but no later than the end of the working day in which the stripping occurs.
6. For shoring/reshoring placed on mud sills, adjustments shall be made by contractor to account for ground settlement.
7. Locate shores/reshores such that the factored (ultimate) construction load imposed onto any slab or beam at any time during the construction cycle does not exceed 90% of the factored (ultimate) design load for that slab or beam, scaled down to reflect effect on capacity of lower concrete strength at time of loading.
8. Construction load shall include the weight of wet concrete, total weight of formwork and shoring/reshoring, and a minimum construction live load of 50 psf (2.5kPa) (increase if construction operations will produce higher loading). Design load includes self-weight of the slab, and superimposed dead and live loads as indicated on the drawings.
9. For comparison of construction loads to design loads, compare factored (ultimate) construction loads to factored (ultimate) design loads. For construction dead and live loads, use the same load factors and load combinations as required by ACI 318 for design dead and live loads. The specified strength reduction factors from ACI 318 should also be applied during the strength evaluation of the partially completed structure.
10. For flat plate or flat slab construction "backshores" or "preshores" as defined in ACI 347 shall be permitted only if appropriate calculations and construction sequences are provided demonstrating that the accumulation of shore loads will not overload any slab. In the absence of such calculations and construction

sequences, shores must be removed and reshores installed in a sequence such that each floor is permitted to deflect and carry its own weight prior to the installation of reshores.

11. Reshores shall not be removed until the concrete has attained its specified 28 day strength.

3.3 REMOVING FORMS

A. Formwork not supporting the weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50ºF (10ºC) for 12 hours after placing concrete, provided concrete is sufficiently hard to avoid damage by form-removal operations, and provided curing and protection operations are maintained after removal of formwork.

B. Formwork supporting the weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed until concrete has attained at least 75% of design compressive strength**.** For multistory buildings, enough shoring should be provided to allow a sufficient number of floors to be built to properly support the construction loading from reshoring.

C. Formwork supporting the weight of concrete for post-tensioned floor framing may not be removed until all post-tensioning operations have been completed and approved. For multistory buildings, enough shoring should be provided to allow a sufficient number of floors to be built to properly support the construction loading from reshoring. See General Notes in the drawings for the minimum compressive concrete strength required for stressing of tendons.

1. Where reshoring is required as part of the formwork removal process, refer to the Shores and Reshores section of this specification.
2. Determination of compressive strength of concrete at time of formwork removal shall be made by cylinder tests on specimens, field-cured the same as the concrete they represent or by the maturity method per ASTM C1074. If the maturity method is used, submit sufficient data using project materials to demonstrate correlation of measurements on the structure with the compressive strength of laboratory-cured molded cylinders.

D. Remove formwork progressively using methods to prevent shock loads or unbalanced loads from being imposed on structure. Comply with ACI 347.

E. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.

F. Whenever formwork is removed during the curing period, the exposed concrete shall be cured per requirements of Section 03 30 00.

G. All wood formwork, including that used in void spaces, pockets and other similar places shall be removed.

H. Form tie holes shall be filled as per approved samples submitted to the Design Professionals.

I. The Contractor shall assume responsibility for all damage due to removal of the forms.

3.4 RE-USING FORMS

A. Before forms can be re-used, surfaces that will be in contact with freshly poured concrete must be thoroughly cleaned, damaged areas repaired, and projecting nails withdrawn.

1. Split, frayed, delaminated or otherwise damaged form-facing material will not be acceptable.
2. Apply new form release agent on re-used forms.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets.

C. Forms for exposed concrete may be reused only if the surfaces have not absorbed moisture and have not splintered, warped, discolored, stained, rusted or peeled, subject to acceptance by the Design Professionals. The Design Professionals reserve the right to require the Contractor to remove and reconstruct such formwork as will produce subsequent areas that are acceptable. Do not use "patched" forms for exposed concrete surfaces, unless approved by the Design Professionals.

3.5 CORRECTIVE MEASURES

A. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in Part 3 – CORRECTIVE MEASURES section of Specification 03 30 00.

END OF SECTION

SECTION 03 20 00 - CONCRETE REINFORCEMENT AND EMBEDDED ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL

Work of this Section shall conform to requirements of Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections.

1.2 SCOPE

Provide all labor, materials, equipment, services and transportation for reinforcing steel, accessories, embedments and miscellaneous anchorage accessories, joint fillers, and waterstops for cast-in-place concrete work as shown on Drawings, as specified herein, and as required by the job conditions.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Quality Assurance: Structural Testing and Inspection	Section 01 45 00
Concrete Formwork	Section 03 10 00
Cast-In-Place Concrete	Section 03 30 00
Thermal and Moisture Protection	Division 7

1.4 CODES AND STANDARDS

A. Building Code: Concrete work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards:

1. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 –Specifications for Structural Concrete.
3. ACI 315 – Details and Detailing of Concrete Reinforcement.
4. ACI 318 – Building Code Requirements for Structural Concrete and Commentary.
5. ACI 355.2 – Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary
6. ACI 355.4 – Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary
7. American Society for Testing and Materials "ASTM Standards in Building Codes", various standards as referenced herein.
8. AWS D1.1 – Structural Welding Code-Steel.
9. AWS D1.4 – Structural Welding Code-Reinforcing Steel.

10. CRD C 572 – Specification for Polyvinylchloride Waterstops.
11. Concrete Reinforcing Steel Institute ”Manual of Standard Practice”
12. ASTM D3963 Fabrication and Jobsite Handling of epoxy Coated Steel Reinforcing Bars.

C. Definitions:

1. See Section 03 30 00.

1.5 CONTRACTOR QUALIFICATIONS

A. The work of this section shall be performed by a fabricator specializing in the type of reinforcement fabrication required for this Project, with a minimum of 10 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

1. Welders shall be qualified in accordance with applicable AWS Code within 12 months before starting the work.

a) Make qualification records available to the Design Professionals upon request.

B. Manufacturers shall specialize in manufacturing the types of concrete accessories required for cast-in-place concrete work, with a minimum of 10 years of documented successful experience and shall have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility and warranty for each type of accessory.

1.6 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested.

(1) Submittal Schedule
(2) Shop Drawings
(3) Product Data
(4) Mill Reports
(5) Reinforcement Strain Test
(6) Hazardous Materials Notification

1. Submittal Schedule: See Section 03 30 00.
2. Shop Drawings: Submit for action shop drawings that shall clearly indicate, but not be limited to:

a) All details, dimensions and information required for fabrication and placement of concrete reinforcement in accordance with Contract Documents, prepared in accordance with ACI 315 recommendations.

b) Elevations, plans, sections, and dimensions of concrete work with required reinforcement clearances.
c) Ledges, brackets, openings, sleeves, anchor rods, embedments, prefabricated bent-in dowel keyway systems, electrical conduit and items of other trades including interference with reinforcing materials.
d) Sizes, grade designations, spacing, locations, and quantities of wire fabric, reinforcement bars, temperature and shrinkage reinforcement dowels.

i. Do not use dimensions scaled from Contract Drawings to determine bar lengths.
ii. Hooks and bends not specifically dimensioned shall be detailed per ACI 318.

e) Bending and cutting schedules, assembly diagrams, splicing and connection requirements, details, and laps.
f) Each type of supporting and spacing devices, including miscellaneous accessories.
g) Construction joint type, details, and locations. Contractor shall coordinate construction joint type, details, and locations with concrete pour schedule. Submittal shall include details for each type of construction joint in accordance with Contract Documents.
h) Locations and dimensions of openings in structural members including floor slab, shear walls, columns and beams. See SUBMITTALS Section of Specification 03 30 00.
i) Concrete accessories and embedded items. See SUBMITTALS Section of Specification 03 30 00.

3. Product Data: Submit for action for each type of product identified in Part 2. Product Data shall be clearly marked to indicate all technical information which specifies full compliance with this section and Contract Documents, including published installation instructions and I.C.C reports, where applicable, for products of each manufacturer specified in this section.
4. Mill Reports: Submit for record.
5. Reinforcement Strain Test: For Grade 75 reinforcement, submit for record certification that steel has a yield strength of no less than 75 ksi as measured by both ASTM A615 and ACI 318 Section 3.5.3.2 procedures.
6. Hazardous Materials Notification: Submit for record. In the event no product or material is available that does not contain hazardous materials as determined by the Owner, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

B. Submittal Process: See Section 03 30 00.

C. SER Submittal Review: See Section 03 30 00.

D. Substitution Request: See Section 03 30 00.

E. Request for Information (RFI): See Section 03 30 00.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions and Division 1, including the following:

1. Deliver reinforcing steel to Project site bundled, tagged and marked.

a) Use weatherproof tags indicating bar sizes, lengths and other information corresponding to markings shown on placement diagrams.

2. Deliver welded wire fabric in sheets. Do not deliver in rolls.
3. During construction period, properly store reinforcing steel and accessories to assure uniformity throughout the Project.
4. Deliver and store welding electrodes in accordance with AWS D1.4.
5. Immediately remove from site materials not complying with Contract Documents or determined to be damaged.
6. Store reinforcing steel above ground so that it remains clean.

a) Maintain steel surfaces free from materials and coatings that might impair bond.
b) Keep covered.
c) Protect against corrosion or deterioration of any kind.

1.8 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

A. See Section 01 45 00.

1.9 QUALITY CONTROL BY CONTRACTOR

A. See Section 03 30 00.

1.10 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

A. See Section 03 30 00.

1.11 PERMITS AND WARRANTY

A. Permits: See Section 03 30 00.

B. Warranty: See Section 03 30 00. Failures include but are not limited to the following:

1. Bars with kinks or bends not indicated on Drawings or on approved shop drawings.
2. Bars damaged due to bending, straightening or cutting.
3. Bars heated for bending.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel:

1. Type: Deformed billet steel bars, ASTM A 615, Grade 60 or 75 as indicated on Drawings.
2. Size: As indicated on structural Drawings.
3. Where indicated on Drawings, reinforcing steel shall be hot-dipped galvanized after fabrication in accordance with ASTM A 767, Class II, with galvanizing material protected from embrittlement during galvanizing process in accordance with ASTM A 143.

    a) Galvanized finish shall meet the bend and shear test requirements of ASTM A 615.

4. Epoxy-Coated: ASTM A 775 where indicated on Drawings.
5. Weldable reinforcement: ASTM A 706 where indicated on Drawings.

B. Welded Wire Reinforcement:

1. Type: steel wire, deformed, ASTM A1064.
2. Size: As indicated on structural Drawings.
3. Where indicated on Drawings, welded wire reinforcement shall be hot-dipped galvanized after fabrication in accordance with ASTM A 1060, , with galvanizing material protected from embrittlement during galvanizing process in accordance with ASTM A 143.

    a) Galvanized finish shall meet the bend and shear test requirements of ASTM A 615.

4. Plain Steel Welded Wire Reinforcement: ASTM A 1064.
5. Deformed Steel Welded Wire Reinforcement: ASTM A 1064.
6. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884, Class A.

C. Headed Shear Stud Reinforcement At Slab-Column Connections:

1. Type: Steel studrail or double headed stud assemblies for shear reinforcement at slab-column connections shall be in accordance with ASTM A 1044. Headed shear studs per AWS D1.1 are not an acceptable substitution for headed shear stud reinforcement. A

    a) Shear studs shall be in accordance with ASTM A108, Grade C1010 through C1018 (yield strength 51,000 psi minimum, tensile strength 65,000 psi minimum).
    b) Rails shall be low carbon steel Type 44W (yield strength 44,000 psi minimum, tensile strength 65,000 psi minimum).
    c) Studs shall be welded in accordance with AWS D1.1.

d) Acceptable Products:

i. Studrails by DECON
ii. DSA by SureBuilt Manufacturing
iii. DSR by Dayton Superior

2. Size, quantity and spacing: As indicated on structural Drawings.
3. Installation: Per manufacturer's instructions.
4. Supports: Use plastic molded plastic chairs as provided by the manufacturer to maintain the bottom rebar cover as specified on the Drawings. Tie headed shear stud reinforcement to adjacent top bars to maintain vertical position.

D. Reinforcement Coating Repair Materials:

1. Apply repair coating in accordance with the manufacturer's written procedures.
2. Galvanized Repair Coating: Zinc-based solder, paint containing zinc dust or sprayed zinc complying with ASTM A780.
3. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/ A 775M.

a) The maximum amount of repaired damaged areas shall not exceed 2% of the surface area in each linear foot of each bar. If more than 2% of the surface area in each linear foot of bar is damaged, bar shall be replaced.

2.2 ACCESSORIES

A. Tie Wire:

1. Type: Minimum 16 gauge (1.5mm) annealed steel wire, ASTM A 510 and ASTM A 853.
2. Wire Bar Type: Comply with CRSI.

B. Mechanical Splicing Systems:

1. Mechanical tension and compression splicing systems shall be used where indicated on Drawings or at contractor's option. For seismic design categories D, E and F, in plastic hinge regions, only Type 2 mechanical splices are permitted.
2. Splices shall be installed in accordance with manufacturer's requirements.
3. Acceptable Products:

a) Bartec Couplers by Dextra
b) Griptec Couplers by Dextra
c) Unitec Couplers by Dextra
d) Lenton Couplers by Erico
e) Lenton Cadweld by Erico
f) Bar Lock Couplers by Dayton Superior
g) Taper-Lock Couplers by Dayton Superior
h) Grip-Twist by BarSplice
i) ZAP Screwlok by BarSplice

j) BPI Barsplicer by BarSplice
k) BarGrip by BarSplice
l) 400 and 500 Series by Headed Reinforcement Corp

4. Mechanical and welded tensile mechanical splicing systems shall be capable of developing 125% of the reinforcing steel ASTM specified minimum yield strength (Type 1) except where indicated as Type 2 (100% of specified tensile strength).
5. Mechanical compression splices shall be such that the compression stress is transmitted by end bearing held in concentric contact.

C. Headed Bars:

1. For bar sizes #11 (ø36) or smaller where specifically detailed on Drawings, mechanical bar terminators shall be used.
2. Headed bars shall meet the requirements of ASTM A970, Class HA.
3. Acceptable Products:

a) Headed Bars by Dextra
b) Lenton Terminator by Erico
c) Grip-Twist Doughnut by Bar-Splice
d) BPI ButtonHead by BarSplice
e) Zap T-Lok by BarSplice
f) Taper-Lock End Anchor Disc by Dayton Superior
g) 100, 550 and 670 Series by Headed Reinforcement Corp

D. Weldable Bar Couplers:

1. Acceptable Products:

a) Lenton Weldable Couplers by Erico
b) DBDI Weldable Coupler by Dayton Superior
c) BPI Structural Connector by BarSplice

E. Slip Dowel Bar/Plate Systems for Slab on Grade Joints

1. Acceptable Products:

a) Speed Dowel or Speed Plate by Sika Corporation
b) QuicDowel or QuicPlate by BoMetals, Inc.
c) Diamond Dowel System by PNA Construction Technologies

F. Supports for Reinforcement:

1. Types: Bolsters, chairs, spacers, clips, chair bars, and other devices for properly placing, spacing, supporting, and fastening the reinforcement, plastic, plastic protected steel, or epoxy coated to match supported reinforcement.
2. For Contact with Forms: Use types with not less than 3/32" (2.5mm) of plastic between metal and concrete surface.

a) Plastic tips shall extend not less than ½" (12mm) on metal legs.

3. Individual and continuous slab bolsters and chairs shall be of type to suit various conditions encountered and must be capable of supporting 300 pound (1.5kN) load without damage or permanent distortion.
4. Unless otherwise indicated on Drawings, bottom reinforcing bars in footings shall be supported by precast concrete bricks or individual high chairs with welded sand plates on bottom.
5. For Slabs on Grade: Use supports with sand plates or horizontal runners where base material will not support chair legs.

G. Deformed Bar Anchors:

1. Type: Automatic end welded, ASTM A 496 quality.
2. Size and Grade: As indicated on structural Drawings by Nelson Stud Welding.

H. Anchor rods and dowels:

1. Types and Sizes: Provide sizes and types of anchor rods and dowels as indicated on the Drawings. Each type of anchor shall be manufactured of structural quality steel, designed for cast-in-place concrete applications and be of sizes as indicated on Drawings, complete with washers, nuts, plates and miscellaneous accessories required to meet Contract Document requirements.
2. Adhesive Anchors for anchor rods and dowels in existing concrete: See Anchorage Accessories.

I. Prefabricated Bent-In Dowel Keyway Systems and Dowel Bar Replacements:

1. Type, Size and Grade as indicated on Drawings.
2. Dowels shall be installed in accordance with manufacturer's requirements
3. Acceptable Products:

a) Lenton Form Savers by Erico
b) Keyway Splice Box by Meadow Burke
c) Metalstrip by Dayton Superior
d) DBDI Splice System by Dayton Superior
e) D50 DBR Coupler System by Dayton Superior
f) BPI Barsplicer by BarSplice
g) 300 Series by Headed Reinforcement Corp

2.3 ANCHORAGE ACCESSORIES

A. General: Miscellaneous anchorage accessories for anchoring structural, architectural, electrical, and mechanical items to poured concrete shall include but not be limited to the following:

1. Concrete Anchors: Headed or bent studs ASTM A 108/Grade 1015 through 1020, minimum yield strength of 50,000 psi (345MPa), minimum tensile strength of 60,000 psi (415MPa).
2. Anchor Rods: ASTM F1554, Grade as noted on Drawings.
3. Shallow Embedment Internally Threaded Inserts with ¾" maximum embedment.

    a) Acceptable Products:

        i. Mini Undercut + by DeWalt (for post-tensioned slabs and precast hollow core slabs)
        ii. HDI-P TZ by Hilti (for post-tensioned slabs)

4. Adhesive Anchors:

    a) Basis of Design: See General Notes
    b) Substitution Request: As anchor capacities vary by manufacturer, the following anchors will be considered as a Substitution Request. Refer to project specifications for Substitution Request procedure

        i. HIT-RE 500-V3 by Hilti, Inc.
        ii. Epcon C6+ by ITW Red Head
        iii. Epcon G5 by ITW Red Head
        iv. Pure 110+ by DeWalt
        v. SET-3G by Simpson Strong-Tie Co.

    c) The adhesive anchor system used for post-installed anchorage to concrete shall conform to the requirements of ACI 355.4 and commentary and shall possess a current ICC- ES report demonstrating compliance with ACI 318.

5. Expansion Anchors:

    a) Basis of Design: See General Notes
    b) Substitution Request: As anchor capacities vary by manufacturer, the following anchors will be considered as a Substitution Request. Refer to project specifications for Substitution Request procedure.

        i. Power Stud+ SD1 or SD2 by DeWalt
        ii. Power Stud + SD6 (SS) by DeWalt
        iii. Trubolt by ITW CCNA
        iv. Strong-Bolt 2 by Simpson Strong-Tie Co.

    c) The expansion anchors used for post-installed anchorage to concrete shall conform to the requirements of ACI 355.2 and commentary and shall possess a current ICC- ES report demonstrating compliance with ACI 318.

6. Threaded Screw Anchors:

a) Basis of Design: See General Notes
b) Substitution Request: As anchor capacities vary by manufacturer, the following anchors will be considered as a Substitution Request. Refer to project specifications for Substitution Request procedure.

i. Screw-Bolt + by DeWalt
ii. Tapcon + by ITW Red Head
iii. Titan HD by Simpson Strong-Tie Co., Pleasanton, CA

7. Inserts and Coil Rods: Yield strength 65,000 psi (450MPa), ASTM B 633, manufactured by Acrow-Richmond Limited or Dayton Superior
8. Welding Electrodes: AWS 5.5, Series E70.
9. Welded Deformed Bar Anchors: Welded by full-fusion process, as furnished by TRW Nelson Stud Welding Division or equivalent.

B. Dovetail Anchor Slots:

1. Type: Formed 22 gauge (0.85mm) galvanized steel
2. Acceptable Manufacturers:

a) Heckmann Building Products
b) Hohmann and Barnard,
c) BoMetals, Inc..

3. Location of Use: Continuous installation of anchor slots, full height of masonry walls, where masonry walls abut poured concrete walls.
4. Fill slot with temporary filler or cover face opening to prevent intrusion of concrete or debris.
5. Finish: Hot-dip galvanized or zinc-plated steel.
6. Stainless steel anchors are acceptable.

2.4 JOINT FILLERS

A. Permanent Compressible Joint Filler:

1. Acceptable Product: W. R. Meadows: "Ceramar" closed-cell expansion joint filler, ultraviolet stable, minimal moisture absorption, non-impregnated, nonstaining and nonbleeding, inert and compatible with cold-applied sealants.
2. Location of Use: Slabs and curbs as indicated on Drawings or required.
3. Thickness: As indicated on Drawings or required.

B. Temporary Compressible Joint Filler:

1. Type: White molded polystyrene beadboard.
2. Location of Use:

a) In slabs, curbs, and walls which must be removed prior to joint sealant installation.
b) Vertically to isolate walls from columns or other walls.

C. Semi Rigid Joint Filler:

1. Acceptable Product: Euclid Chemical Company “Euco 700” or “Euco QWIKjoint 200”
2. Acceptable Product: Sika Corporation “Sikadur 51 SL”
3. Acceptable Product: W.R. Meadows Sealtight “Rezi-Weld Flex”

D. Noncompressible Joint Filler:

1. Acceptable Product: Dow Chemical's "STYROFOAM 40" rigid closed-cell extruded polystyrene board, square edges, 40 psi (275kPa) compressive strength, ASTM C 578, Type IV.
2. Thickness: As indicated on Drawings.
3. Location of Use: As indicated on Drawings or required.

E. Asphalt-Impregnated Joint Filler:

1. Acceptable Product: W.R. Meadows Asphalt Expansion Joint Filler, preformed, ASTM D 994.
2. Thickness: ½” (12mm) maximum, as indicated on Drawings or required.
3. Location of Use: Sidewalks at foundation walls and as indicated on Drawings or required.

F. Asphalt-impregnated fiberboard expansion joint filler for interior work:

1. Type: ASTM D1751.

G. Self-expanding cork board expansion joint filler for exterior work:

1. Type: ASTM D1752.

H. Construction Joints:

1. Type: Tongue and groove type profile of galvanized steel, with knock-out holes at 6" (150mm) on center to receive dowelling, complete with anchorage.

2.5 WATERSTOPS

A. Preformed Swellable Waterproofing Strips especially formulated for concrete cold joints at footings, walls, or slabs.

1. Acceptable Products:

a) Volclay Waterstop RX by CETCO Building Materials Group
b) Adcor ES by GCP Applied Technologies
c) Hydrotite by Sika

2. Size: 3/4" (20mm) by 3/8" (10mm) strips minimum, 25 ft. (7.5m) long, and weighing at least 0.165 lbs/ft (0.245kg/m).
3. Location of Use: Concrete cold joints at footings, walls and slab joints.

4. Comply with manufacturer product application and installation instructions.

B. Polyvinyl Chloride Waterstops:

1. Type: PVC Waterstops for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections and directional changes. U.S. Corp of Engineers Specification CRD C 572.
2. Acceptable Products:

a) PVC Waterstops" by BoMetals
b) Greenstreak by Sika
c) Sealtight PVC Waterstops by W.R. Meadows

PART 3 - EXECUTION

3.1 FABRICATION

A. Reinforcing Steel Fabrication:

1. Fabricate in accordance with approved shop Drawings, ACI 315 and Contract Documents.
2. Heating of Reinforcement: Will be permitted only with specific prior approval of the SER.
3. Welding: Comply with ANSI/AWS D1.4; use E9018 electrodes or approved electrodes.
4. Tolerances: Comply with ACI 117.
5. Unacceptable Materials: Reinforcement with any of following defects will not be permitted in Work.

a) Bar lengths, depths, and bends exceeding ACI fabrication tolerances.
b) Bends or kinks not indicated on Drawings or final shop drawings.
c) Bars with reduced cross-section due to excessive rusting or other cause.

B. Welded Wire Reinforcement:

1. Type: As fabricated in accordance with CRSI, unless otherwise noted.

C. Templates:

1. Required for all footing and column dowels, and where required for proper alignment of reinforcing.

D. Assemblies:

1. Fabricate and assemble structural steel items in shop in conformance with AISC and AWS D1.1. Shearing, flame cutting, and chipping shall be done carefully and accurately. Cut, drill, or punch holes at right angles to the surface of the metal. Do not make or enlarge holes by burning. Holes shall be clean-cut without torn or ragged edges.

2. Welding of deformed bar anchors and headed stud anchors shall be installed by full-fusion process equivalent to TRW Nelson Stud Welding Division or KSM Welding Services Division, Omark Industries or Tru-Weld Stud Welding, Medina, OH.
3. Welding of reinforcement shall be done in accordance with AWS requirements. Welding shall be performed subject to the observance and testing by Testing Agency.
4. Galvanizing where required, shall be applied after fabrication and prior to casting concrete.
5. Welding of crossing bars (tack welding) for assembly of reinforcement is not permitted without use of weldable reinforcement and express written consent of SER.

3.2 INSTALLATION OF REINFORCEMENT

A. General:

1. Perform the work of this section in accordance with approved shop drawings, ACI 318 and CRSI recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as specified.
2. Before placing reinforcement steel, inspect forms for proper fitting and compliance with allowable tolerances.
3. Reinforcement shall be free of form coatings, sealers, powdered and scaled rust, loose mill scale, earth, ice, and other materials which will reduce or destroy bond with concrete.
4. Do not place concrete until the completed reinforcement steel work has been observed and accepted by Owner's Testing Laboratory.
5. Reinforcement steel is not permitted to be "floated into position".
6. Bend bars cold.

    a) Do not heat or flame cut bars.
    b) No field bending of bars partially embedded in concrete is permitted, unless specifically approved by the SER and tested by Testing Agency for cracks.

7. Weld only as indicated.

    a) Perform welding per ANSI/AWS D12.1 and/or ANSI/AWS D1.4.
    b) See structural Drawings for additional requirements.

8. Tag reinforcement steel for easy identification.

B. Placement of Reinforcement Bars:

1. Comply with approved shop drawings, ACI 318 and Contract Documents.
2. Accurately position, support and secure reinforcement in a manner to prevent displacement before and during placement of concrete.

    a) Place reinforcement bars within tolerances specified in ACI 117.

b) Locate and support reinforcement by metal chairs, runners, bolsters, spacers, hangers and other accessories for fastening reinforcing bars and welded wire reinforcement in place.

3. If bars are displaced beyond specified tolerance when relocating the bars to avoid interference with other reinforcement or embedded items, immediately notify the Design Professionals for approval prior to concrete placement.
4. Avoid cutting or puncturing vapor retarder during reinforcement placement.

a) Repair damages before placing concrete.

5. Concrete Coverage: Maintain concrete cover around reinforcement as indicated on Drawings.
6. Bar Supports: Use type specified in this section.
7. Tie Wires: After cutting, turn tie wires to the inside of section and bend so that concrete placement will not force ends to be exposed at face of concrete.

C. Placement of Wire Reinforcement:

1. Install in lengths as long as practicable.
2. Support in position adequately to prevent bending of reinforcement between supports before and during placement of concrete.
3. Overlap the wire reinforcement 6” (150mm) or one panel width + 2” (50mm), whichever is larger.

a) Securely tie together with wire.

4. Offset laps of adjoining widths to prevent continuous laps in either direction.
5. Locate wire fabric in the top third of slabs, unless noted otherwise on structural Drawings.

D. At Construction Joints:

1. Reinforcement bars and wire reinforcement shall be continuous through construction joints, unless otherwise indicated on Drawings. See Drawings for scheduled lap splices.

E. At Expansion Joints:

1. Reinforcing bars and wire fabric shall NOT be continuous through expansion joints, unless otherwise indicated on Drawings.

F. Splicing:

1. Unless otherwise indicated on Drawings provide lap splices for bar sizes #11 (ø36) and smaller by lapping ends, placing bars in contact, and tying tightly with wire in accordance with requirements of ACI 318 for lap lengths indicated on Drawings.

2. At all #14 (ø43) and #18 (ø57) bars and where mechanical splices are specifically indicated on Drawings, comply with requirements specified in this Specification section under "Mechanical Splicing Systems".
3. Do not splice reinforcement except as indicated on structural Drawings.
4. Tension couplers may be used and installed per manufacturer's specifications where indicated on Drawings or as approved by Engineer.

G. Dowels in Existing Concrete:

1. Install dowels and dowel adhesive in accordance with manufacturer's recommendations.
2. Minimum embedment length shall be 12 bar diameters, unless noted otherwise.

3.3 INSTALLATION OF POST-INSTALLED ADHESIVE ANCHORS

A. General:

1. Post-installed adhesive anchors shall be installed in accordance with the Manufacturer's Printed Installation Instructions (MPII).
2. The adhesive anchors shall be supplied as an entire system. The contractor shall provide all equipment required to install the adhesive anchor in accordance with the MPII.
3. Anchors shall be installed in holes drilled with a rotary impact hammer drill with carbide bit. Contractor shall obtain prior written approval from SER before using rock drilling or core drilling installation methods.
4. Anchor holes shall be thoroughly cleaned and dry prior to adhesive injection, in accordance with the MPII. Anchors to be installed in the adhesive shall be clean, oil-free, and free of loose rust, paint, or other coatings.
5. Concrete shall have a minimum compressive strength of 2500 psi (17MPa).
6. Concrete at time of adhesive anchor installation shall have a minimum of 21 days.
7. Concrete temperature at the time of adhesive anchor installation shall be at least equal to manufacture's requirements, or 50° F (10°C) if no requirement exists.
8. Support the anchor and protect it from disturbance or loading for the full cure time stated by the manufacturer at that base material temperature.
9. Unless specified otherwise in the contract documents, anchors shall be installed perpendicular to the concrete surface. Anchors displaced or disturbed prior to the adhesive cure time shall be considered damaged and reported to the SER (see Observations and Corrections section of 03 30 00).
10. Locate, by non-destructive means, and avoid all existing reinforcement prior to installation of anchors. If existing reinforcement layout prohibits the installation of anchors as indicated in the drawings the contractor shall immediately notify the Design Professionals.
11. Reinforcement bars or all-threaded bars shall not be bent after being adhesively embedded in hardened, sound concrete, unless written approval is given by the SER.

12. All personnel installing anchors shall be trained by the manufacturer on proper installation techniques. Submit for record certificate from training documentation from the manufacturer for each installer on this Project
13. Installation of adhesive anchors horizontally or upwardly inclined and anchors that are designated with a (CERT) after the anchor call-out, shall be performed by personnel certified by the ACI/CRSI Adhesive Anchor Installer Certification program. Submit for record certificate from ACI-CRSI Adhesive Anchor Installation Certification Program for each certified installer on this Project.

3.4 INSTALLATION OF ACCESSORIES AND EMBEDDED ITEMS

A. Install concrete accessories in accordance with manufacturer's published instructions and Contract Documents.

1. Set and secure embedments, including embedded plates, bearing plates, and anchor rods, per approved setting drawings and in such a manner to prevent movement during placement of concrete and to allow removal of formwork without damage.
2. Tolerances: Anchor rod and other embedded items placement tolerances shall comply with AISC 303, “Code of Standard Practice”, Section 7.5.
3. Inspect locations to receive concrete accessories.
4. Immediately notify the Design Professionals in writing of conditions that will adversely affect the Work or fail to meet Contract Document requirements.
5. Do not place concrete until reinforcement, accessories and other built-in items have been inspected and accepted by Testing Agency.

B. Construction and Contraction (Control) Joints:

1. Construction and contraction (control) joints indicated on Drawings are mandatory and must not be omitted.

    a) Provide construction joints in accordance with ACI 318.
    b) Roughen surface at construction joints as indicated on the drawings.
    c) Where specifically indicated on drawings, provide 1-1/2” (40mm) deep key type construction joints at end of each placement for slabs, beams, walls and footings.

        i. Bevel forms for easy removal.

2. Provide waterstops in construction joints as indicated on the Contract Documents in sizes to suit joint.
3. Install waterstops to form continuous diaphragm in each joint.
4. Support and protect exposed waterstops during progress of Work.
5. Field-fabricate joints in waterstops according to manufacturer’s printed instructions.

C. Coordinate the installation of pipes, bolts, hangers, anchors, flashing and other embedded items with the work of other trades.

3.5 CORRECTIVE MEASURES

A. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in Part 3 – CORRECTIVE MEASURES section of Specification 03 30 00.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 GENERAL

Work of this Section shall conform to requirements of Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections.

1.2 SCOPE

Provide all labor, materials, equipment, services and transportation required to complete all concrete work as shown on Drawings, as specified herein, and as required by the job conditions. This Specification is not intended to address the particular requirements of Architectural Concrete.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Quality Assurance: Structural Testing and Inspection	Section 01 45 00
Concrete Formwork	Section 03 10 00
Concrete Reinforcement and Embedded Assemblies	Section 03 20 00
Thermal and Moisture Protection	Division 7

1.4 CODES AND STANDARDS

A. Building Code: Concrete work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards:

1. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials except as modified by more stringent requirements in the Project Specifications and/or Drawings.
2. ACI 237 – Self Consolidating Concrete.
3. ACI 301 – Specifications for Structural Concrete.
4. ACI 318 – Building Code Requirements for Structural Concrete and Commentary.
5. American Concrete Institute “Manual of Concrete Practice”, various committee reports as referenced herein.
6. American Society for Testing and Materials "ASTM Standards in Building Codes", various standards as referenced herein.
7. AASHTO T318 – Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.

C. Definitions:

1. The term "Contract Documents" in this Specification is defined as the design Drawings and the specifications.
2. The term "SER" in this Specification is defined as the Structural Engineer of Record for the structure in its final condition.
3. The term "Design Professionals" in this Specification is defined as the Owner's Architect and SER.
4. The term "Contractor" in this Specification is defined to include any of the following: General Contractor and their sub-contractors, Construction Manager, Concrete Contractor and their sub-contractors.
5. The term "Testing Agency" in this Specification is defined as an independent testing and inspection service engaged by the Owner for quality assurance testing and inspection of structural construction in accordance with applicable building code provisions and any additional activities listed in the Contract Documents.
6. The terms "for record" and "submit for record" in this Specification are defined as Contractor submittals that do not require a response from the Design Professionals.
7. The term "Working Days" in this Specification is defined as Monday through Friday, excluding federal or state holidays.
8. The term "Delegated Design" in this Specification is defined as a scope of work that meets performance and design criteria established in the Contract Documents and is to be completed by the Contractor's licensed engineer.

1.5 CONTRACTOR QUALIFICATIONS

A. The work of this section shall be performed by a company specializing in the type of concrete work required for this Project, with a minimum of 10 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

B. Contractor's testing agency services: Required as specified in Division 1, and herein.

1.6 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested. Reproduction of structural drawings for shop drawings is not permitted. Building Information Models for contractor's use may be provided as mutually agreed upon by Design Professionals.

B. Submittal Schedule

(1) Mix Designs
(2) Concrete Travel Times to the Project Site
(3) Hot and Cold Weather Procedures
(4) Product Data
(5) Concrete Joint Locations
(6) Comprehensive Layout Drawings
(7) Preconstruction Survey

(8) Survey of Flat Plate or Flat Slab Concrete Floors during construction
(9) FF/FL Testing
(10) Structural Repairs
(11) Patching Defective Concrete Finishes
(12) Conduit and Pipes Embedded in Concrete
(13) Hazardous Materials Notification

1. Submittal Schedule: The contractor shall submit for action a schedule at least twenty (20) working days prior to commencing submittals.

   a) This schedule shall include a list, in order of date to be submitted, of all drawings and other required submittal items scheduled to be submitted. The schedule shall list the proposed submittals for each week, as well as their formats. Once shop drawing submissions have commenced any modification or addition to this schedule must be submitted for action at least twenty (20) working days before the modification or addition is proposed to take place.
   b) If at any time the total number of shop drawings received in any one week period exceeds the amount in the approved schedule by more than 10% for that week, the Design Professionals have the right to add two days to the average turnaround time for each 20% increment in excess of the scheduled quantity for that week's submissions. For example if the weekly total exceeds the schedule by 10% to 20%, two days may be added; if it is exceeded by 21% to 40%, four days may be added. The return dates for subsequent submittals may be extended based on the additional review time stated above.
   c) For the purposes of developing a schedule, assume the following review rate, Shop drawings – 10 full size sheets per week.

2. Mix Designs: Submit for action concrete mix designs for each type and strength of concrete required for this Project at least thirty (30) days before placing concrete.

   a) Mix designs shall be prepared or reviewed by an approved independent testing agency retained by the Contractor in accordance with requirements of ACI 301 and ACI 318 and shall be coordinated with design requirements and Contract Documents.
   b) Before submitting to Testing Agency, submit complete mix design data for each separate mix to be used on the Project in a single submittal.
   c) Provide a completed "Concrete Mix Design Submittal Form" (attached to the end of this Specification Section) for each proposed concrete mix.
   d) Mix materials shall be from the same production facility that will be used for this Project.
   e) Mix Design data shall include but not be limited to the following:

      i. Locations on the Project where each mix design is to be used corresponding to Structural General Notes on the Drawings.
      ii. Design Compressive Strength: As indicated on the Drawings.
      iii. Proportions: ACI 301 and ACI 318.

iv. Gradation and quality of each type of ingredient including fresh (wet) unit weight, aggregates sieve analysis.
v. Water/cementitious material ratio.
vi. Evaluation and classification fly ash in accordance with ASTM D 5759.
vii. Report of chemical analysis of fly ash in accordance with ASTM C 618.
viii. Classification of slag cement in accordance with ASTM C 989.
ix. Slump: ASTM C 143.
x. Certification and test results of the total water soluble chloride ion content of the design mix - AASHTO T260 or ASTM C 1218 at age between 28 and 42 days.
xi. Air content of freshly mixed concrete by the pressure method, ASTM C 231, or the volumetric method, ASTM C 173.
xii. Density of Concrete: ASTM C 138.
xiii. Design strength at 28, 56 or 90 days, as indicated on Contract Documents: ASTM C 39.

(1) Document strength based on basis of previous field experience or trial mixtures per ACI 301. Proportioning by water-cement ratio alone, with no test results per the trial mixtures procedure is not permitted.
(2) Submit strength test records, mix design materials, conditions, and proportions for concrete used for record of tests, standard deviation calculation, and determination of required average compressive strength. Test records to support proposed mixtures shall be no more than 24 months old and use current cement aggregate sources. Test records to establish standard deviation may be older if necessary to have the required number of samples.
(3) If early concrete strengths are required, Contractor shall submit trial mixture results as required.

xiv. Manufacturer's product data for each type of admixture.
xv. Manufacturer’s certification that all admixtures used are compatible with each other.
xvi. All information indicating compliance with Contract Documents including method of placement and method of curing.
xvii. Normalweight Concrete: Density per ASTM C 138. Design the mix to produce the strength, modulus of elasticity and density as indicated on the Contract Documents.
xviii. Lightweight Concrete: Density per ASTM C 138. Design the mix to produce the strength, modulus of elasticity and density as indicated on the Contract Documents.
xix. Certification from a qualified testing agency indicating absence of potential for deleterious expansion of concrete due to alkali reactivity of the aggregate as determined by testing per ASTM C1260 in accordance with ASTM C 33. If potential for

deleterious expansion exists, expansion reduction and mitigation measures per the guidelines of ASTM C1778 or US Army COE CRD-C662 shall be submitted for review by the SER.

3. Concrete Travel Times to the Project Site: Submit for record.
4. Hot and Cold Weather Procedures: Submit for record written procedures for placement of concrete in hot and cold weather conditions. Hot and Cold weather are as defined in the Concrete Placement section of this Specification.
5. Product Data: Submit for action product data clearly marked to indicate locations to be used and all technical information which specifies full compliance with this section and Contract Documents, including published application instructions, product characteristics, compatibility, and limitations for each of the following:

    a) Bonding agents.
    b) Curing compound and liquid sealer densifier. Submit for record to Design Professionals a written statement guaranteeing that the compound will not leave discoloration on concrete to be left exposed, or affect the bond for paint or other applied finishes. Include provision in written statement that in the event of failure of applied finishes to bond to membrane cured concrete, to remove the curing compound and leave suitable surfaces for bonding such finishes.
    c) Absorptive covers and moisture retaining covers.
    d) Vapor Retarder: See Division 7, Thermal and Moisture Protection.
    e) Self-leveling concrete topping.
    f) Grout: Submittal of grout by manufacturers not listed herein must be accompanied by independent certification of ASTM C 1107 compliance without modification of standard methods.
    g) Other products proposed by Contractor.

6. Concrete Joint Locations: Submit for action plans indicating locations and details of construction joints, contraction joints, waterstops, sleeves, embedments, etc. that interact with the joints. Contractor to coordinate joint location with reinforcement shop drawings. Reinforcement shop drawings shall indicate additional reinforcement bars where required at construction joints.

    Joint locations for concrete slabs to receive a terrazzo or similar finish subject to reflective cracking must be coordinated with layout of finish drawings.

7. Comprehensive Layout Drawings: Submit for action comprehensive layout drawings (a single drawing per area/element):

    a) Drawings shall show openings in structural members, including floor slab, shear walls, columns and beams.
    b) Drawings shall consolidate the work of all trades and shall be coordinated by the Contractor.
    c) Drawings shall show concrete accessories and embedded items, including fabrication details of items to be placed (exclusive of reinforcement).

d) Submit with or prior to reinforcement and formwork submittals for same element/area.

8. Preconstruction Survey: Submit for record. Where interface with existing construction occurs, before related shop drawings are prepared survey the existing construction and submit the survey prepared by a professional surveyor employed by the Contractor to the Design Professionals.
9. Survey of Flat Plate or Flat Slab Concrete Floors during construction: Submit for record. Survey requirements are described on Drawings. Based on survey results, SER may propose adjustments to formwork and camber.
10. FF/FL Testing: Submit for record. Testing Agency to test and report flatness (F_F), levelness (F_L) prior to shoring removal. For slabs that include camber, do not test for levelness (F_L). Perform F_F/F_L testing in accordance with ASTM E 1155 requirements.
11. Structural Repairs: Submit for action procedures, intended locations, and product information. Alterations to design shall be sealed and signed by a Professional Engineer licensed in the state where the project is located.
12. Patching Defective Concrete Finishes: Submit for action procedures, intended locations, and product information.
13. Conduit and Pipes Embedded in Concrete: Submit for action layout of embedded conduit and pipes.
14. Hazardous Materials Notification: Submit for record. In the event no product or material is available that does not contain hazardous materials as determined by the Owner, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

C. Submittal Process

1. Submittal of shop drawings and other submittals by the Contractor shall constitute Contractor's representation that the Contractor has verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each drawing with other Drawings and other trades. The Contractor shall place their shop drawing stamp on all submittals confirming the above.
2. Shop drawings: Submit in complete packages so that individual parts and the assembled unit may be reviewed together. This Specification Section and the applicable Drawings used in the development of the shop drawings shall be referenced on each shop drawing to facilitate checking.
3. The Contractor shall submit to the Design Professionals one (1) electronic copy for shop drawing review. The naming convention of each drawing must follow the submittal numbering system and include the submittal number, Specification number, revision number and drawing number in the prefix of the drawing name.
4. The Contractor shall allow at least ten (10) working days between receipt and release by the SER for the review of shop drawings and submittals.
5. All modifications or revisions to submittals and shop drawings must be clouded, with an appropriate revision number clearly indicated. The following shall automatically be considered cause for rejection of the modification or revision whether or not the drawing has been approved by the Design Professionals:

a) Failure to specifically cloud modifications
b) Unapproved revisions to previous submittals
c) Unapproved departure from Contract Documents

6. Resubmittals: Completely address previous comments prior to resubmitting a drawing. Resubmit only those drawings that require resubmittal. Do not include new content not previously reviewed.
7. Resubmittals Compensation: The Contractor shall compensate the Design Professionals for submittals that must be reviewed more than twice due to Contractors' errors. The Contractor shall compensate the Design Professionals at standard billing rates plus out-of-pocket expenses incurred at cost + 10%.
8. The Contractor shall deliver to the Design Professionals at the completion of the job two (2) copies of the electronic version of the final as-built shop drawings on a CD-ROM or other media acceptable to the Design Professionals.

D. SER Submittal Review

1. The Design Professionals' review and approval of shop drawings and other submittals shall be for general conformance with the design intent of the work and with the information given in the Contract Documents only and will not in any way relieve the Contractor or the Contractor's Engineer from:

a) Conforming to the Contract Documents.
b) Coordination with other trades.
c) Responsibility for all required detailing and proper fitting of construction work.
d) The necessity of furnishing material and workmanship required by Drawings and Specifications which may not be indicated on the shop drawings.
e) Control or charge of construction means, methods, techniques, sequences or procedures, for safety precautions and programs in connection with the work.

2. TYPE 1 – Structural Submittal Review Stamp: For shop drawings for building elements designed by the SER, the responses on the shop drawing review stamp used by the SER require one of the following actions:

a) APPROVED indicates that the SER has found that the information presented on the shop or erection drawing appears to conform to the requirements of the Contract Documents. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the Contract Documents.
b) APPROVED AS NOTED indicates that the SER requires the shop or erection drawing to be corrected to reflect the notes and comments shown. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the notations shown on the shop drawings and the Contract Documents. Promptly resubmit the corrected shop or erection drawing for record.

c) REVISE and RESUBMIT indicates that the SER requires resubmission of the shop or erection drawing after correction per notes and comments. None of the elements of work shown on the shop drawing shall be fabricated, manufactured or constructed until the Contractor has received a returned shop drawing marked Approved or Approved as Noted.

d) NOT APPROVED indicates that the shop or erection drawing does not conform to the Contract Documents and must be extensively revised before re-submittal. None of the elements of work shown on the shop drawing shall be fabricated, manufactured or constructed until the Contractor has received a returned shop drawing marked Approved or Approved as Noted.

3. TYPE 2 – Delegated Design Review Stamp: For submittals for building elements which are not designed by the SER but are delegated design items, or for items that do not form part of the completed structural system but impose loads on the structure, or for construction items or activities which have an effect on the final structure. The responses on the stamp used by the SER require one of the following actions:

a) NO EXCEPTIONS indicates that the SER has found that the information presented on the submittal appears to conform to the requirements of the Contract Documents. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the Contract Documents.

b) EXCEPTIONS NOTED indicates that the SER requires the submittal be corrected to reflect the notes and comments shown. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the notations shown on the shop drawings and the Contract Documents. Promptly resubmit the corrected document for record.

c) REJECTED indicates that the SER requires resubmission of the submittal after correction per notes and comments. None of the elements of work shown on the shop drawing shall be fabricated, manufactured or constructed. Contractor to revise and resubmit until SER response of No Exceptions or Exceptions Noted is received.

E. Substitution Request

1. Requests for any departure from Contract Documents must be submitted in writing by the Contractor and accepted in writing by the Design Professionals, prior to receipt of submittals.
2. All substitutions must be requested using the structural substitution request form included at the end of this section. Acceptance using the structural substitution request form indicates acceptability of the structural concept only. Contractor must submit shop drawings reflecting accepted substitutions for review in accordance with this Specification. The structural substitution request form, even if accepted, does not constitute a change order.
3. Accepted substitutions or modifications shall be coordinated and incorporated in the work at the sole expense of the Contractor.

4. The acceptance by the Design Professionals of a specific and isolated request by the Contractor to deviate from these requirements does not constitute a waiving of that requirement for other elements of, or locations in the project, unless specifically addressed as such and permitted by the Design Professionals in writing.
5. Compensation for Additional Services: Should additional work by Design Professionals such as design, documentation, meetings and/or site visits be required which are necessitated for the review and/or incorporation of the Contractor-requested substitution, including indirect effects on other portions of the work, the Contractor is responsible for paying for additional work performed by the Design Professionals at the standard billing rates plus out-of-pocket expenses incurred at cost + 10%. Additional costs for testing and inspection by the Owner shall also be compensated by the Contractor.
6. Contractor is responsible for means and methods and any impacts on other portions of the work that may arise from this substitution.

F. Request for Information (RFI)

1. RFIs shall be submitted by the Contractor. RFIs submitted by other entities will be returned with no response.
2. Limit RFI to one subject.
3. Submit RFI immediately upon discovery of the need for interpretation or clarification of the Contract Documents. Submit RFI within timeframe so as not to delay the Construction Schedule while allowing the full response time described below.
4. The response time for answering an RFI depends on the category in which it is assigned.

    a) Upon receipt by the SER, each RFI will be assigned to one of the following categories:

        i. No cost clarification
        ii. Shown in Contract Documents
        iii. Change to be issued in future document revision
        iv. Previously answered
        v. Information needs to be provided by others
        vi. Request for corrective field work
        vii. Request for substitution

    b) RFIs in the first five categories listed above will be turned around by the SER on average of five (5) working days.
    c) RFIs in the last two categories listed above will be immediately rejected and must be submitted as submittals or requests for substitution.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions and Division 1.

B. Storage:

1. Store materials in accordance with ACI 304R.
2. Store cement in weather-tight buildings, bins or silos that will exclude moisture and contaminates.
3. Store admixtures to avoid contamination, evaporation, damage, and in accordance with manufacturer's temperature and other recommendations.
4. Keep packaged material in original containers with seals unbroken and labels intact until time of use.

C. Handling:

1. Handle fine and coarse aggregates as separate ingredients.
2. Arrange aggregate stockpiles to avoid excessive segregation, and prevent contamination with other materials or with other sizes of like aggregates.
3. Do not use frozen or partially frozen aggregates.
4. Allow sand to drain until it has reached relatively uniform moisture content before use.
5. Protect liquid admixtures from freezing and temperature changes that would adversely affect characteristics, and in accordance with manufacturer's recommendations.

1.8 PRE-CONCRETE CONFERENCE

A. At least 30 working days prior to the start of concrete construction, the Contractor shall hold a meeting to review the proposed concrete mix designs and to determine the procedures for producing proper concrete construction. The Contractor shall notify the Design Professionals of the meeting and require responsible representatives of every party who is concerned with the concrete Work to attend the conference, including but not limited to the following:

1. Contractor’s superintendent.
2. Testing Agency representative responsible for field quality control.
3. Concrete subcontractor.
4. Ready-mix concrete producer.
5. Admixture manufacturer(s).
6. Architect.
7. Structural Engineer.

B. Minutes of the meeting shall be recorded and distributed by the Contractor to all parties concerned within five working days of the meeting. One copy of the minutes shall also be furnished to the following:

1. Design Professionals.
2. Owner's Representative.

C. The minutes shall include a statement by the concrete contractor and admixture manufacturer(s) indicating that the proposed mix design and placing, finishing, and curing techniques can produce the concrete properties and quality required by these Specifications.

1.9 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

A. See Section 01 45 00.

1.10 QUALITY CONTROL BY CONTRACTOR

A. The Contractor shall provide a program of quality control to ensure that the minimum standards specified herein are attained.

B. The Owner's general review during construction and activities of the Testing Agency are undertaken to inform the Owner of performance by the Contractor but shall in no way replace or augment the Contractor's quality control program or relieve the Contractor of total responsibility for quality control.

C. The Contractor shall immediately notify the Design Professionals of any deficiencies in the work which are departures from the Contract Documents. The Contractor shall propose corrective actions and their recommendations in writing and submit them for review by the Design Professionals. After proposed corrective action is accepted by the Design Professionals and Owner, the Contractor shall correct the deficiency at no cost to the Owner. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in the OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS section of this Specification.

D. Where SCC is used, the Ready Mix Producer shall have a Quality Control Representative on site during placements until mix consistency and stability is established.

1.11 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

A. Observations: The Design Professionals will observe the construction for general compliance with the provisions of the Contract Documents during various phases of construction.

B. Corrections by Design Professionals: See Part 3 - CORRECTIVE MEASURES section of this Specification.

1.12 PERMITS AND WARRANTY

A. Permits: The Contractor shall apply for, procure, renew, maintain, and pay for all permits required by City, State, or other governing authorities, necessary to execute work under this Contract. Contractor shall furnish copies of all permits to the Owner and Design Professionals.

B. Warranty: Comply with General Conditions, agreeing to repair or replace specified materials or work that has failed within the warranty period. Failures include but are not limited to the following:

1. Oily, waxy or loose residue which may interfere with the bonding or discoloration of various applied Architectural finish materials.
2. Discoloration of concrete surfaces scheduled to remain exposed as a finish.
3. Areas which show surface failure or defects.

4. Areas which puddle water.
5. Areas which are not properly prepared to receive Architectural finish materials. If necessary, the Contractor, at his own expense, shall have the Testing Agency perform appropriate tests for bond and discoloration.
6. Patches that become crazed, cracked or sound hollow when tapped.
7. Self-leveling concrete topping that has cracked, spalled and/or not performed in accordance with manufacturer's design criteria.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS AND PRODUCTION

A. Portland Cement:

1. ASTM C150, Type I or Type II
2. ASTM C150, Type III, High-early Strength Portland Cement may be used subject to review and approval of the SER. The specified 28-day concrete compressive strength shall occur within 7 days for concrete using Type III Portland Cement.
3. Provide the same brand of Portland Cement from a single source throughout the project, as required to meet Design Professionals' requirements.

B. Blended Hydraulic Cement:

1. ASTM C595, Type IL, Portland-Limestone Cement
2. ASTM C595, Type IS, Portland-Slag Cement
3. ASTM C595, Type IP, Portland-Pozzolan Cement
4. ASTM C595, Type IT, Ternary-Blended Cement
5. ASTM C595, Type IT (HS) plus pozzolan or slag cement for Exposure Class S3

C. Aggregates for Normalweight Concrete:

1. ASTM C 33
2. Fine Aggregate: Natural sand, or sand prepared from stone or gravel, clean, hard, durable, uncoated and free from silt, loam and clay.
3. Provide aggregates from a single source throughout the project for exposed concrete.
4. The acceptability of aggregates for the work will depend on proof that their potential alkali reactivity is not deleterious to the concrete.
5. Do not use fine or coarse aggregates that contain substances that cause spalling.
6. Maximum coarse aggregate size shall conform to the requirements as specified in ACI 301 but shall not exceed the following:

   Size no. 57 (25mm max) for footings, drilled piers and caissons
   Size no. 67 (20mm max) for all other locations
   Size no. 467 or 457 for non-reinforced concrete at locations noted on Drawings.

7. Contractor shall furnish concrete with maximum 3/8" (10mm) aggregate at no additional cost to the Owner if areas of high reinforcement density require it for placement and consolidation.

D. Aggregates for Lightweight Concrete:

1. ASTM C 330: Except aggregates prepared by processing natural materials, such as pumice, scoria, or tuff.
2. Classification of Aggregates: As required to meet Design Professional's requirements.
3. Provide aggregates from a single source throughout the project for exposed concrete.
4. Aggregate shall contain the minimum absorbed moisture content recommended by the manufacturer for the project prior to batching.
5. Maximum coarse aggregate size shall conform to the requirements as specified in ACI 301 but shall not exceed ¾" (20mm)

E. Water: ASTM C 1602. Clean, and free from injurious amounts of oil, acids, alkali, salts, organic material, or other deleterious materials.

F. Supplementary Cementitious Material

1. Fly Ash: ASTM C 618, Class C or Class F.
2. Slag Cement: ASTM C 989.
3. Silica Fume (Microsilica): ASTM C1240.

a) Acceptable Products:

i. Force 10,000 D by GCP Applied Technologies, Inc.
ii. Eucon MSA by Euclid Chemical Company
iii. MasterLife SF 100 by BASF Coroporation
iv. Sikacrete 950 DP by Sika Corporation

4. Metakaolin: ASTM C 618, Class N.

a) Acceptable Products:

i. MetaMax by BASF Kaolin, part of BASF Corporation
ii. HRMK 100 by GCP Applied Technologies, Inc.
iii. Sikacrete M-100 by Sika Corporation

5. For concrete assigned to Exposure Classes F1 and F2, as defined in ACI 318, there is no limit to the maximum amount of supplementary cementitious materials included in the mix as a percentage of total cementitious materials by mass.
6. For concrete assigned to Exposure Class F3 as defined in ACI 318, limits to the maximum amount of supplementary cementitious materials included in the mix as a percentage of total cementitious materials by mass are as follows:

a) Fly ash or other pozzolans conforming to ASTM C618 = 25%
b) Slag cement = 50%

c) Silica fume = 10%
d) Total of fly ash or other pozzolans and silica fume = 35%
e) Total of fly ash or other pozzolans, slag cement and silica fume = 50%
f) The maximum percentage limits listed above shall include the supplementary cementitious materials used in the manufacture of ASTM C595 blended cements.

7. The fly ash or natural pozzolan supplier shall have an effective quality control program in place to guard against contamination of the fly ash and assure compliance with Specifications.
8. Supplementary Cementitious Materials shall be from one source throughout the project. Substitution of sources will be acceptable only if testing of concrete mixes containing the substituted material show similar test results and if the color of concrete produced with the substituted material matches the color of previously poured concrete to the satisfaction of the Architect.

G. Ready Mixed Concrete:

1. Shall be batch-mixed and transported in accordance with ASTM C 94.

H. Self-Consolidating Concrete:

1. Produce in accordance with ACI 237R.
2. Perform the following tests and provide report prior to submitting mix design:

a) Resistance to Segregation: Achieve a maximum static segregation percentage of 15% when tested according to ASTM C 1610 with a VSI index of 1 maximum.
b) Slump Flow: ASTM C 1611 within a range of 20”-30” (500mm–750mm).
c) Passing Ability: ASTM C 1621 with a maximum difference of 2” (50mm) between testing with and without the J-Ring.

2.2 CONCRETE MIX DESIGN

A. Concrete Strength:

1. Shall be as indicated on the Structural Drawings
2. Where concrete strength is not indicated on the drawings, the minimum concrete strength for exposure classes as defined in ACI 318 are as follows:

a) F0, S0, W0, C0, C1 = 2500 psi
b) F1 = 3500 psi
c) S1, W1 = 4000 psi
d) F2, S2, S3, = 4500 psi
e) F3, C2 = 5000 psi

B. Concrete Density (Unit Weight):

1. Shall be as indicated on the Structural Drawings

C. Air Entrainment

1. For concrete exposed to freeze/thaw cycles and/or deicing chemicals (ACI 318 Exposure Classes F1, F2, F3), and concrete intended to be watertight, provide entrained air content of 6% ± 1.5%, unless specified otherwise. This includes, but is not limited to, concrete at the following locations:

    a) Concrete at the exterior of the structure with at least one surface exposed to weather, such as exterior face of grade beams, foundation walls, exterior walls and parapets, exposed columns and edge beams.
    b) Floor framing and ramps in parking garages.
    c) Loading docks.
    d) Balconies and terraces with no waterproofing membrane.

2. For lightweight concrete less than 120 pcf (19 kN/m³) density, air content may be up to 7% regardless of exposure condition.
3. For concrete with a specified compressive strength (f'c) greater than 5000 psi (35MPa), required air content may be reduced to 5% ± 1.5%.
4. Entrained air content noted above shall occur at point of delivery.
5. No entrained air content is required for foundations with no surface exposed to weather.
6. All interior steel trowel finished, normal weight slabs shall have a maximum air content of 3%.

D. Water-Cementitious Material Ratio (w/cm) for Normalweight Concrete

1. The total combined weight of Portland cement and all other supplementary cementitious material shall be used to determine the w/cm.
2. The w/cm shall not exceed the values indicated below, including any water added to meet specified slump in accordance with the requirements of ASTM C 94.
3. Based on Exposure Class, as defined in ACI 318, the following maximum w/cm shall be provided:

    a) Exposure Class F0, S0, W0, C0, C1, no maximum
    b) Exposure Class F1, max w/cm=0.55
    c) Exposure Class S1, W1, max w/cm=0.50
    d) Exposure Class F2, S2, S3, max w/cm=0.45
    e) Exposure Class F3, C2, max w/cm=0.40

4. Concrete used in slab on grade shall have a maximum w/cm ratio of 0.45.

E. Slump

1. Concrete design mixes shall be proportioned to meet the following slump limitations. Slump should be measured as described in the Testing Agency responsibilities:

    a) Concrete with high range or mid range water-reducing admixture: Concrete slump prior to addition of high range water-reducing admixture

shall not exceed 3" +/- 1" (75mm) for normalweight concrete and 4" +/- 1" (100mm) for lightweight concrete. After addition of water-reducing admixture, the concrete shall have a maximum slump of 9" +/- 1" (225mm) unless otherwise approved by the SER.

b) Concrete without a water-reducing admixture: Slump shall not exceed 4" +/- 1".

F. Self-Consolidating Concrete Slump/Flow: Use for concrete exposed to view and heavily reinforced areas where indicated on the plans, and where conventional mixtures do not provide adequate consolidation. Minimum slump/flow diameter of 20" (500mm) or as required by the successful test placement onsite, which shall verify proper workability, finish, and setting time. All self-consolidating concrete shall contain the specified high range water-reducing admixture. All self-consolidating concrete shall contain viscosity modifying admixture as required unless proper quantity and grading of fines can be achieved.

G. Chloride Ion Content

1. The total water-soluble chloride ion content of the mix including all constituents shall not exceed the limits defined in ACI 318 unless corrosion inhibiting admixtures are added to the mixture to offset the additional chloride.
2. If the specified level of water-soluble chloride ion content cannot be maintained, appropriate level of corrosion inhibiting admixture shall be added to the mix in accordance with the manufacturer's recommendation to offset the excess amount of chloride at no additional cost to the Owner.

2.3 ADMIXTURES

A. General:

1. Admixtures specified below can be used only when established in the mix design with Design Professionals' prior written approval.
2. Each admixture approved by Design Professionals shall be used in strict compliance with manufacturer's published instructions.
3. Concrete supplier shall certify all admixtures to be compatible with each other. (See Submittals Section in Part 1)

B. Air Entraining Admixture:

1. ASTM C 260
2. Acceptable Products:

a) MasterAir Series by BASF Corporation
b) Darex Series or Daravair Series by GCP Applied Technologies, Inc.
c) EUCON AEA –92 or EUCON Air Series by Euclid Chemical Company
d) AIR Series or AEA-14 by Sika Corporation

C. Water-Reducing Admixture:

1. ASTM C 494, Type A

2. Acceptable Products:

    a) MasterPozzolith Series by BASF Corporation
    b) EUCON NW or EUCON WR 91 by Euclid Chemical Company
    c) WRDA Series, Zyla Series or Mira Series by GCP Applied Technologies, Inc.
    d) Plastocrete Series by Sika Corporation

D. Retarding Admixture:

1. ASTM C 494, Type B
2. Acceptable Products:

    a) MasterSet R Series or MasterSet DELVO Series by BASF Corporation
    b) EUCON RETARDER 100 by Euclid Chemical Company
    c) Daratard 17 by GCP Applied Technologies, Inc.
    d) Plastiment Series by Sika Corporation

E. Non Corrosive Accelerating Admixture:

1. ASTM C 494, Type C
2. Acceptable Products:

    a) MasterSet FP 20 or MasterSet NC 534 by BASF Corporation
    b) ACCELGUARD 80, ACCELGUARD NCA or ACCELGUARD 90 by Euclid Chemical Company
    c) Daraset" Series, Polarset, or DCI by GCP Applied Technologies, Inc.
    d) Sikaset Series or Rapid-1 by Sika Corporation

F. Water-Reducing and Retarding Admixture:

1. ASTM C 494, Type D
2. Acceptable Products:

    a) MasterSet R Series or MasterSet DELVO Series by BASF Corporation
    b) EUCON RETARDER 75 or EUCON DS by Euclid Chemical Company
    c) Daratard 17 or Recovery Series by GCP Applied Technologies, Inc.
    d) Plastiment Series by Sika Corporation

G. Water-Reducing and Accelerating Admixture:

1. ASTM C 494, Type E
2. Acceptable Products:

    a) MasterSet FP 20 by BASF Corporation
    b) ACCELGUARD 80 or ACCELGUARD 90 by Euclid Chemical Company
    c) Libricon NCA by GCP Applied Technologies, Inc.
    d) Sikaset NC by Sika Corporation

H. Mid-Range Water-Reducing Admixture:

1. ASTM C 494, Type A
2. Acceptable Products:

    a) MasterPolyheed Series by BASF Corporation
    b) Daracem or Mira by GCP Applied Technologies, Inc.
    c) Sikaplast Series or Sikament Series by Sika Corporation
    d) Eucon MR or Eucon MRX by Euclid Chemical Company

I. High-Range Water-Reducing Admixture:

1. ASTM C 494, Type F
2. Acceptable Products:

    a) MasterGlenium Series by BASF Corporation
    b) EUCON 37 or PLASTOL SERIES by Euclid Chemical Company
    c) Daracem or ADVA Series by GCP Applied Technologies, Inc.
    d) Viscocrete Series or Sikament Series by Sika Corporation

J. High-Range Water-Reducing Admixture for production of Control Flow Concrete:

1. ASTM C494 Type A and F and ASTM C1017 Type I
2. Acceptable Product:

    a) CONCERA SA8080 by GCP Applied Technologies, Inc.

K. High-Range Water-Reducing and Retarding Admixture:

1. ASTM C 494, Type G
2. Acceptable Products:

    a) EUCON 537 by Euclid Chemical Company
    b) Daracem Series or Adva Series by GCP Applied Technologies, Inc.

L. Workability Retaining Admixture:

1. ASTM C494, Type S
2. Acceptable Products:

    a) MasterSure Z-60 by BASF Corporation
    b) Visco Flow-2020 by Sika Corporation

M. Permeability-Reducing Admixture:

1. ASTM C494, Type S
2. Shall be a Portland cement based crystalline capillary waterproofing admixture that reacts in concrete to form non-soluble crystalline hydration products in the capillary pores of concrete,
3. Acceptable Products:

    a) MasterLife 300D by BASF Corporation
    b) Eucon Vandex AM-10 by Euclid Chemical Company

c) Admix C-Series by Xypex

N. Viscosity Modifying Admixture (VMA) for Self-Consolidating Concrete (SCC):

1. ASTM C 494, Type S
2. Acceptable Products:

a) MasterMatrix VMA Seriesby BASF Corporation
b) V-MAR3 by GCP Applied Technologies, Inc.
c) EUCON ABS or EUCON WO or VISCTROL by Euclid Chemical Company
d) Sika Stabilizer-4R by Sika Corporation

O. Corrosion Inhibiting Admixtures:

1. Calcium Nitrite Based: ASTM C 1582 and ASTM C 494, Type C, 30% + 2% solution

a) Acceptable Products:

i. DCI or DCI-Sby GCP Applied Technologies, Inc.
ii. MasterLife CI 30 by BASF Corporation
iii. EUCON CIA by Euclid Chemical Company
iv. Sika-CNI by Sika Corporation

2. Amine Carboxylate Based: ASTM C 1582, which includes ASTM C-494 amine carboxylate

a) Acceptable Product:

i. MCI 2005, MCI 2005 NS, MCI 2006 or MCI 2006 NS by Cortec Corporation

3. Amino Alcohol Based:

a) Acceptable Product:

i. FerroGard 901 by Sika Corporation
ii. MasterLife CI 222 by BASF Corporation

P. Shrinkage Reducing/Compensating Admixtures:

1. ASTM C 494, Type S
2. Acceptable Products:

a) Eclipse Floor 200 or Eclipse 4500 (for use with air-entrained concrete) by GCP Applied Technologies, Inc.
b) Conex or EUCON SRA Floor or EUCON SRA-XT (for use with air-entrained concrete) by Euclid Chemical Company
c) MasterLife SRA Series or MasterLife CRA 007 by BASF Corporation
d) SikaControl 75 by Sika Corporation

e) PREVent-C by PremierCPG

Q. Alkali-Silica Reaction Inhibiting Admixture:

1. ASTM C 494, Type S
2. Shall contain a nominal lithium nitrate content of 30 percent.
3. Dosage to be determined in accordance with US Army COE CRD-C662
4. Acceptable Products:

a) MasterLife ASR 30 by BASF Corporation
b) Eucon Integral ARC by Euclid Chemical Company
c) RASIR by GCP Applied Technologies

R. Porosity Inhibiting Admixture:

1. ASTM C494, Type S
2. Sodium silicate free
3. Manufacturer must be able to provide a flooring adhesion guarantee and life of the concrete vapor transmission warranty. In order to obtain warranty, product must be installed in compliance with the manufacturer's published data sheet including but not limited to proper on-site representation, mix design review, concrete testing and installation of vapor retarder for slabs on ground.
4. Acceptable Products:

a) Barrier One by Concrete Moisture Solutions, Inc.

S. Carbon Dioxide ($C0_2$) Mineralization:

1. Where called for on the drawings or when approved by the SER, provide concrete that has undergone carbonization treatment with carbon dioxide ($C0_2$) during mixing, such that $C0_2$ is chemically mineralized into the concrete.
2. $C0_2$ injected into the mix must be post-industrial $C0_2$ sourced from a nearby emitter. Provide concrete producer's certificate outlining quantity, location and supplier of $C0_2$.
3. Acceptable Product:

a) Carbon Cure by CarbonCure Technologies.

2.4 FIBER REINFORCEMENT

A. General:

1. Fiber reinforcement specified below can be used only with Design Professional's prior written approval.
2. See Drawings for location of Fibers.
3. Where macro synthetic fiber reinforcement is proposed as a substitution request to replace welded wire reinforcement, Contractor shall demonstrate that proposed material and dosage rate provides equivalent performance to the welded wire reinforcement indicated on Drawings.
4. Fiber reinforcement shall not replace reinforcing bars shown on Drawings.

B. Synthetic Fibrillated or Monofilament Micro Fibers (low volume synthetic used for reduction of plastic shrinkage cracking)

1. ASTM C 1116, Type III polyolefin fibers engineered and designed for use in making fiber-reinforced concrete.
2. Acceptable Products:

    a) SINTA F38, SINTA M2219 by GCP Applied Technologies, Inc.
    b) PSI Fiberstrand by Euclid Chemical Company
    c) Fibermesh 150-e3 or 300-e3 by Sika Corporation
    d) MasterFiber F Series or MasterFiber M Series by BASF Corporation

C. Synthetic Macro Fibers (high volume synthetics used for reduction of plastic and drying shrinkage cracking)

1. ASTM C 1116, Type III polyolefin fibers engineered and designed for use in making fiber-reinforced concrete.
2. The fibers shall provide a minimum equivalent flexural residual strength (fe_3) of 150 psi (1.0 MPa), unless otherwise noted on the drawings, when tested in accordance with ASTM C1609.
3. When synthetic macro fibers are used as a replacement for welded wire reinforcement in composite slabs, contractor shall submit documentation that the fibers are Underwriters Laboratories (UL) certified for the fire ratings as indicated on the drawings. Provide dosage of fibers as required to meet the fire resistance rating but not less than 4 pounds per cubic yard (2.4 kg/m^3).
4. Acceptable Products:

    a) Strux 90/40 by GCP Applied Technologies, Inc.
    b) Tuf-Strand SF by Euclid Chemical Company
    c) Fibermesh 650-e3 by Sika Corporation
    d) MasterFiber MAC 100 by BASF Corporation

D. Synthetic Hybrid Fibers

1. ASTM C1116, Type III polyolefin fibers engineered and designed for use in making fiber-reinforced concrete.
2. The fibers shall provide a minimum equivalent flexural residual strength (fe_3) of 150 psi (1.0MPa), unless otherwise noted on the drawings, when tested in accordance with ASTM C1609.
3. When synthetic macro fibers are used as a replacement for welded wire reinforcement in composite slabs, contractor shall submit documentation that the fibers are Underwriters Laboratories (UL) certified for the fire ratings as indicated on the drawings but not less than 4 pounds per cubic yard (2.4 kg/m^3).
4. Acceptable Products:

    a) MasterFiber MAC 360 FF by BASF Corporation
    b) Novomesh 950 by Sika Corporation

E. Carbon Steel Fibers (smooth or deformed)

1. ASTM C1116, Type I containing steel fibers designed for use in making fiber reinforced concrete meeting the criteria of ASTM A820, Type I, II or V
2. The fibers shall provide a minimum equivalent flexural residual strength (fe_3) of 200 psi (1.4 MPa), unless otherwise noted on the drawings, when tested in accordance with ASTM C1609.
3. When steel fibers are used as a replacement for welded wire reinforcement in composite slabs, contractor shall submit documentation that the fibers are Underwriters Laboratories (UL) certified for the fire ratings as indicated on the drawings but not less than 25 pounds per cubic yard (14.8 kg/m^3).
4. Acceptable Products:

    a) Dramix 3D, 4D, 5D by Bakaert Corporation
    b) CAR-25-CDM by Fibercon International Inc.
    c) Novocon CHE7560H by Sika Corporation
    d) PSI Steel Fiber 6560 by Euclid Chemical Company
    e) CFS 100-2 or CFS-150-5 by Concrete Fiber Solutions
    f) Helix Micro Rebar by Helixsteel

2.5 ADHESIVES

A. Epoxy Bonding Agent for bonding hardened concrete to hardened concrete (existing concrete damp or dry, at least 28 days old, no surface water):

1. ASTM C 881 Type IV, Grade 1, 2 or 3, Class B or C as appropriate for field temperature conditions.
2. Acceptable Products:

    a) Acceptable Product: Dural 452 Series by Euclid Chemical Company
    b) Rezi-Weld 1000 by W. R. Meadows
    c) Sure Bond J58 by Dayton Superior

B. Epoxy Bonding Agent for bonding freshly mixed concrete to hardened concrete (existing concrete damp or dry, less than 28 days old, no surface water):

1. ASTM C 881, Type V, Grade 1, 2, or 3, Class B or C as appropriate for field temperature conditions.
2. Acceptable Products:

    a) Dural 452 Gel or 452 MV by Euclid Chemical Company
    b) Sikadur 32 Hi-Mod by Sika Corporation
    c) Rezi-Weld 1000 by W. R. Meadows
    d) Sure Bond J58 by Dayton Superior

C. Anti-Corrosive Epoxy Modified Cementitious Bonding Compound and Corrosion Protection of Reinforcement (bonding agent for existing concrete saturated surface dry, no surface water):

This adhesive shall be a water-based epoxy/cementitious compound for adhesion and corrosion protection of reinforcing members (20 hour maximum open time).

1. Acceptable Products:

    a) DURALPREP AC by Euclid Chemical Company
    b) ARMATEC 110 EpoCem by Sika Corporation
    c) MasterEmaco P124 by BASF Corporation
    d) Perma Prime 3C by Dayton Superior

2.6 CURING COMPOUNDS AND SEALERS

A. Interaction with finishes:

1. See architectural Drawings for finish material applied over concrete.
2. Use only curing and sealer compounds that are compatible with finish, waterproofing or roofing material.

B. Curing and Sealing Compound (VOC Compliant, 350 g/l) :

1. ASTM C1315, Type I, Class A and/or ASTM C 309, Type 1, Class A or B
2. Water based acrylic, clear, 25% solids curing and sealing compound.
3. Acceptable Products:

    a) Super Diamond Clear VOX by Euclid Chemical Company
    b) Cure & Seal 1315 J22WB by Dayton Superior
    c) VOCOMP-25 by W. R. Meadows
    d) Dress & Seal WB 30 or Lumiseal WB by Laticrete International, Inc.

C. Curing Compound-Dissipating/Strippable (VOC Compliant, 350 g/l):

1. ASTM C 309, Type I, Class A or B
2. Water based resin, clear curing compound that begins to dissipate when exposed to UV light and traffic.
3. Acceptable Products:

    a) Kurez DR VOX by Euclid Chemical Company
    b) Clear Resin Cure J11W by Dayton Superior
    c) 1100 by W. R. Meadows

D. Surface Applied Vapor Emission Mitigation

1. Shall conform to state and federal VOC regulaions with zero VOC content.
2. Shall provide a 15 year warranty against flooring failure due to negative-side moisture vapor migration of moisture-born alkalinity.
3. Acceptable Products:

    a) CS2000 by Creteseal

E. Liquid Densifier/Sealer:

1. The liquid densifier compound shall be a silicate based compound that penetrates and chemically hardens concrete surfaces.
2. Acceptable Products:

a) Euco Diamond Hard by Euclid Chemical Company
b) Acceptable Product: Dayton Superior “Densifier J13”
c) MasterKure HD 200WB by BASF Corporation
d) Liqui-Hard by W. R. Meadows

F. Evaporation Retarder:

1. Acceptable Products:

a) MasterKure ER50 by BASF Corporation
b) Eucobar by Euclid Chemical Company
c) Sika Film by Sika Corporation

2.7 DRY SHAKE HARDENERS

A. Mineral Aggregate Hardener:

1. The specified mineral aggregate hardener shall be a factory-blended mixture of specially processed graded non-metallic aggregate.
2. Acceptable Products:

a) Euclid Chemical Company, "Surflex" to be used with “Kurez DR VOX”
b) MasterTop 100 to be used with “MasterKure CC 200WB by BASF Corporation
c) Quartzplate FF to be used with Dress & Seal WB 30 by Laticrete International, Inc.

B. Non-Oxidizing Metallic Hardener:

1. The specified non-oxidizing metallic floor hardener shall be a mixture of specially processed non-rusting aggregates.
2. Acceptable Products:

a) Euclid Chemical Company, “Diamond-Plate” to be used with “Kurez DR VOX”
b) MasterTop 210COR to be used with “MasterKure CC 200WB by BASF Corporation
c) Emeryplate FF to be used with Lumiseal WB by Laticrete International, Inc.

2.8 MISCELLANEOUS CONCRETE AND CONCRETE RELATED PRODUCTS

A. Cementitious Non-Shrink Grout:

1. Provide pre-packaged high-precision, non-shrink, non metallic grout.
2. See General Notes for grout minimum compressive strength.
3. ASTM C 1107
4. Acceptable Products:

a) MasterFlow 928 by BASF Corporation
b) Dry Pack Grout or HI-FLOW GROUT by Euclid Chemical Company

c) Five Star Grout by Five Star Products
d) Sikagrout 328 by Sika Corporation
e) Duragrout by Latticrete International, Inc.

B. Self-Leveling Concrete Topping - Underlayment for Interior Applications:

1. Use self-leveling underlayment concrete formulated to level concrete floors without shrinking, cracking or spalling, and capable of being placed from feathered edge to 1" (25mm) thickness without aggregate in one pour. If greater than 1" (25mm) thickness is required, aggregate shall be extended with aggregate in accordance with manufacturer's requirements. Appropriate primer shall be utilized for all underlayment applications.
2. Acceptable Products:

a) K-15 by Ardex
b) Flo-Top or Super Flo-Top by Euclid Chemical Company
c) Sika Level Series by Sika Corporation

C. Moisture-Retaining Covers:

1. ASTM C171
2. A naturally colored, non-woven polypropylene fabric with a non-perforated reflective polyethylene coating containing stabilizers to resist degradation from ultraviolet light. Fabric shall exhibit low permeability and high moisture retention.
3. Acceptable Products:

a) Hydracure S-16 by PNA Construction Technologies, Inc.
b) Transguard 4000 by Amorlon a Division of Reef Industries , Inc.
c) UltraCure NCF by Sika Corporation
d) Top Cure by Transhield

D. Expanded Polystyrene (EPS) used as Fill - Geofoam

1. Material: Rigid, closed cell polystyrene blocks formed by expansion of polystyrene beads by steam.
2. Comply with the requirements of ASTM D 6817
3. Unless noted otherwise on the drawings, provide the following types of EPS:

a) Fill between a lower slab and a raised slab area: EPS12 -2.2 psi (15 kPa) compressive resistance minimum at 1% deformation, 10 psi (70 kPa) flexural strength minimum
b) Fill below exterior floor slabs or slabs with truck loading: EPS19 - 5.8 psi (40 kPa) compressive resistance minimum at 1% deformation, 30 psi (200 kPa) flexural strength minimum

4. Thickness as indicated on Drawings.
5. Execution: Conform to manufacturer’s instructions regarding preparation, installation and protection

6. Gripper plates shall be used as needed to restrain EPS from moving laterally in multi-layer applications
7. Contractor shall sequence soil or concrete topping placement to avoid EPS block shift or flotation.
8. Submit the following for review:

    a) Manufacturer's product literature including physical properties in compliance with ASTM D 6817 and type specified
    b) 10 year physical property warranty
    c) Proposed plan layout of fill blocks showing gaps between blocks where required for stabilizing and/or load bearing reinforced concrete ribs as shown on drawings, in details or in notes.

9. Submit the following for record:

    a) Summary of test compliance with specified performance characteristics and physical properties
    b) Product Certificates showing evidence of third party quality control

10. Acceptable Manufacturers:

    a) ACH Foam Technologies
    b) Atlas EPS
    c) Universal Construction Foam

E. Vapor Retarder: See Division 7, Thermal and Moisture Protection

1. Minimum 15-mil thick polyolefin membrane
2. Manufactured with prime virgin resins
3. Water Vapor Retarder: ASTM E 1745, meets or exceeds Class A
4. Water Vapor Transmission Rate: ASTM E 96, 0.008 gr./ft2/hr. (0.086 gr./m²/hr) or lower
5. Permeance Rating: ASTM E 96, 0.03 Perms or lower for new material and after conditioning tests in accordance with applicable sections of ASTM E 154
6. Puncture Resistance: ASTM E 1745,minimum 2200 grams
7. Tensile Strength: ASTM E 1745, minimum 45.0 lbs./in (8.0 kg/cm).
8. Acceptable products:

    a) Floprufe 120 by GCP Applied Technologies, Inc.
    b) Perminator by W. R. Meadows
    c) Stego Wrap by Stego Industry LLC
    d) Raven Vapor Block 15 by Raven Industries
    e) Husky Yellow Guard 15 Mil by Poly-America

F. Non-Slip Aggregate:

1. Abrasive crushed and graded aggregate, high in aluminum oxidegregate which is unaffected by moisture or cleaning compounds.
2. Acceptable Products:

a) Non-Slip Aggergate by Euclid Chemical Company
b) Emery Non-Slip by Dayton Superior
c) A-H Emery Emerundum by Anti-Hydro International, Inc.

2.9 CONCRETE REPAIR MATERIALS

A. Polymer-Modified Repair Mortar

1. The following patching mortars may be used when color match of the adjacent concrete is not required. Prior approval by the Design Professionals is required.
2. Acceptable Products-Horizontal Surfaces:

a) Tammspatch II or Tamms Thin Patch by Euclid Chemical Company
b) Sikatop 122 Plus by Sika Corporation
c) Meadow-Patch T1 or T2 or Meadow-Crete GPS by W. R. Meadows
d) Duracrete by Laticrete International, Inc.

3. Acceptable Products-Vertical and Overhead Surfaces:

a) MasterEmaco N400 by BASF Corporation
b) Verticoat, Vertacoat Supreme or Dualtop Gel by Euclid Chemical Company
c) SikaTop 123 Plus by Sika Corporation
d) Meadow-Crete GPS by W. R. Meadows

B. Crack Repair:

a) Euco Qwikstitch or Dural 50 LM by Euclid Chemical Company
b) MasterSeal 630 by BASF Corporation
c) T78 Methyl Methacrylate Crack Sealer by Transpo Industries, Inc.

C. High Strength Flowing Repair Concrete:

1. For forming and pouring large volume repairs, provide shrinkage compensated repair concrete with integral corrosion inhibitor.
2. Minimum compressive strength 8000 psi (56MPa) @ 28-days
3. Prior approval by the Design Professionals is required for cold weather applications
4. Acceptable Products:

a) Eucocrete by Euclid Chemical Company
b) MasterEmaco S 466 CI by BASF Corporation
c) Meadow-Crete FNP by W. R. Meadows

D. Epoxy Injection:

1. ASTM C881
2. Acceptable Products:

a) MasterInject 1380 by BASF Corporation
b) Dural Injection Gel by Euclid Chemical Company

c) Sikadur 35 LV LPL by Sika Corporation
d) Rezi-Weld LV State by W. R.Meadows

E. Pressure-Injected Foam Resin:

1. Acceptable Products:

a) De Neef Sealform PURe by GCP Applied Technologies
b) Crack-Pac Flex-H2O by Simpson Strong-Tie
c) SikaFix HH LV by Sika Corporation

F. Semi Rigid Joint Filler:

1. Acceptable Products:

a) MasterSeal CR 190 by BASF Corporation
b) Euco 700 or Qwikjoint UVR by Euclid Chemical Company
c) MM-80 by Metzger/McGuire
d) Rezi-Weld Flex by W. R, Meadows

G. Methyl Methacrylate (MMA)

1. Acceptable Products:

a) MasterSeal 630 by BASF Corporation
b) Transpo Industries, Inc. “T-78 Methyl Methacrylate Polymer Crack Healer/Sealer”
c) MMA #884 by Epoxy Systems

H. Sealant:

1. Silicone or Polyurethane Sealant (as selected based on project requirements such as loading, traffic, bond, coatings, etc.).
2. Joint to be routed and cleaned per manufacturer’s written directions.
3. Acceptable Products:

a) MasterSeal Sealants by BASF Corporation
b) Sikaflex-1C SL and Loadflex 524 EZ by Sika Corporation
c) Pourthane NS by W. R. Meadows
d) Eucolastic 1NS by Euclid Chemical Company

PART 3 - EXECUTION

3.1 TOLERANCES

A. Work shall conform to all requirements of ACI 117 except as modified by more stringent requirements in the Project Specifications and/or Drawings.

3.2 PREPARATION

A. Subgrade:

1. Dampen subgrades not covered with membrane by sprinkling immediately before placing concrete.

    a) Omit when subgrade is already damp.

2. Do not place on water-saturated subgrade unless placing can be done without damage to subgrade (surface is stable) and loading the subgrade does not drive free water to the surface.
3. Do not place concrete on frozen ground.

B. Forms:

1. Coordinate with Section 03 10 00 Concrete Formwork.
2. Remove dirt, sawdust, nails and other foreign material from formed space.
3. Dampen wood forms by sprinkling immediately before placing.
4. Cool metal forms by sprinkling immediately before placing.

C. Concrete Accessories:

1. Coordinate with Section 03 10 00 Concrete Formwork.

D. Dewatering:

1. Remove water from concrete formwork.
2. Divert any flowing water to sump and remove by pumping.
3. Refer to Division 1 for additional dewatering requirements.

E. Vapor Retarder Placement: See Division 7, Thermal and Moisture Protection.

1. Vapor retarder installation shall be in accordance with manufacturer's instructions and ASTM E 1643.
2. Place vapor retarder under slabs-on-grade in position with longest dimension parallel with direction of pour.
3. Joints: Lap 6" (150mm) minimum and seal with manufacturer's recommended mastic or pressure-sensitive tape.
4. Prevent damage to moisture barrier.
5. If moisture barrier is damaged, place a piece of moisture barrier over damaged area (6" (150mm) larger all around) and tape in place with type of tape recommended by moisture barrier manufacturer.
6. Seal laps and intersections of walls with compatible trowel mastic or pressure-sensitive sealing tape.
7. Seal around pipes and other penetrations with compatible trowel mastic.
8. The vapor barrier installation must be approved prior to concrete placement.

3.3 JOINTS IN CONCRETE

A. Locate construction and contraction joints as indicated on Drawings and on approved joint location submittal.

1. Do not use contraction joints in framed floors or composite slabs.
2. Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Design Professionals.
3. Coordinate location of construction and contraction joints with locations of joints in finish materials where they exist.

    a) Construction and contraction joints in slabs or slab on grade with terrazzo finish must be reviewed and approved by the Design Professionals.

4. Maximum joint spacing is as indicated on Drawings.

B. Construction Joints:

1. Construction joints shall be located within the central third of the span. Any concrete spilling over or through the bulkhead shall be removed at the completion of the pour. All surfaces of the concrete shall have reinforcing extending through the joint.
2. Horizontal Joints: Horizontal construction joints other than those shown on the Drawings will not be permitted unless approved by the Architect.
3. Joint Preparation: Forms shall be removed in time to permit roughening of construction joints of structural members by chipping and wire brushing to remove all loose and foreign material and roughen as indicated on the Drawings. The existing concrete at joints shall either be (a) dampened to the point that the surface is saturated, but all standing water has been removed, promptly followed by placement and vibration of fresh concrete, or (b) not required to be dampened, with one of the specified bonding compounds applied as appropriate for the joint condition, following manufacturer recommendations, with placement and vibration of fresh concrete to follow while the epoxy bonding agent is still tacky. Joints without epoxy bonding agent require fresh concrete with slump 7 inches (180mm) or greater at horizontal joints, and fresh concrete confined to maintain pressure against the joint at vertical joints. Where such conditions are not present, or where applying water to dampen the surface is impractical, use epoxy bonding agent suitable for dry surfaces

C. Isolation Joints:

1. Interrupt structural continuity resulting from bond, reinforcement or keyway at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls and other locations, as indicated.

D. Contraction Joints in Floor Slabs-on-Grade:

1. Maximum slab area controlled by jointing is 400 square feet (35 square meters).

2. Space joints at 36 times slab thickness unless a smaller spacing is indicated on the Drawings, located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
3. Contraction joints can be provided by sawcuts, formed joints or appropriately detailed construction joints.
4. Sawcuts shall be made as soon as possible after slab finishing as may be safely done without dislodging aggregate. The Soff-Cut saw shall be used to a depth of ¼ of slab thickness immediately after final finishing. Conventional saw shall be used as soon as possible after final finish without raveling to a depth as indicated on the Drawings.
5. Where contraction joints coincide with construction joints, detail joint as indicated on Drawings.

E. Joint Fillers: Coordinate with Section 03 20 00 Concrete Reinforcement and Embedded Assemblies and Division 7 requirements.

3.4 MIXING

A. Measurement of Materials: Conforming to ASTM C 94.

B. Mixing: All concrete shall be ready-mixed conforming to ASTM C 94 except as follows:

1. Provide concrete materials, proportions and properties as herein specified in lieu of ASTM C 94.
2. Water, beyond that required by the mix design, shall not be added at the Project site. Addition of water at the Project site shall be made only in the presence of the Testing Agency.
3. Furnish delivery ticket with each load of concrete delivered to the site to the Contractor conforming to the requirements of ASTM C 94.

C. High range water reducing agents (superplasticizer), if added at the batch plant, may be added again at the Project site.

1. If superplasticizers are added at the batch plant, the concrete mix design must account for the delivery time, workability, finishability, and setting time required on the jobsite for proper placing and finishing procedures.
2. If the superplasticizer is redosed at the jobsite in air entrained concrete, air content must be checked after mixing.

D. Discharge of the concrete shall be completed within 1-1/2 hours , after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates. If the 1-1/2 hour limit cannot be achieved due to project location or other project specific conditions, hydration control measures to extend the proper workability up to 4 hours maximum can be proposed for approval by the SER. The increased time period along with redosing of the high range water reducer and/or use of hydration controlling/workability retaining admixtures should be agreed upon at the pre-concrete conference.

3.5 CONCRETE PLACEMENT

A. Prior to Concrete Placement:

1. Mechanical vibrators are required and must be available for placing concrete.
2. Remove debris from space to be occupied with concrete.
3. Notify Design Professionals and Testing Agency 48 hours prior to starting concrete placement.
4. Approved mix designs must be maintained on file in Contractor's Field Office.
5. Reinforcement and accessories shall be in proper locations, clean, free of loose scale, dirt or other foreign coatings that may reduce bond to concrete, and in accordance with Section 03 20 00 and Drawings.
6. Fog spray forms, reinforcing steel, and subgrade just before pouring concrete.
7. Do not place concrete having a slump outside of allowable slump range.
8. Place concrete before initial set has occurred, but in no event after it has been discharged from the mixer more than 30 minutes. All concrete shall be placed upon clean, damp surfaces, free from puddled water, or upon properly consolidated fills or upon Controlled Low-Strength Material with a strength between 50 and 1200 psi. Placement upon soft mud or dry earth is not permitted.
9. Unless adequate protection is provided, concrete shall not be placed during rain.
10. Rain water shall not be allowed to increase mixing water or to damage the surface finish.
11. At surfaces left exposed to view, do not use equipment in placing and finishing concrete that contain aluminum in the finishing edges that come in contact with the concrete surface.
12. Keep subgrade moisture uniform without puddles or dry areas.
13. Place vapor retarder directly below slabs on grade as specified in Contract Documents.

B. For Conduits and Pipes Embedded in Concrete:

1. For concrete slab, wall, beam or column, conform to requirements of ACI 318. For variations from these requirements, submit a written request for Design Professionals' review and response.
2. Conduits and pipes shall not be embedded in concrete slabs on steel deck without approval of Design Professional.
3. Provide sleeves for pipes passing vertically through concrete.
4. Do not embed aluminum materials.
5. Do not cut, bend or displace the reinforcement to facilitate placement of embedded pipes and conduits.

C. Pumping: Pumping shall be done in strict accordance with ACI 304.2R.

D. Placing Concrete in Forms:

1. Clean and prepare forms as specified in Section 03 10 00/Concrete Formwork.
2. Place concrete continuously without interruption between predetermined construction and contraction joints in walls.
3. Deposit concrete in forms in horizontal layers no deeper than 24” (600mm) and in a manner to avoid inclined construction joints.

4. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
5. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping.

    a) Use equipment and procedures for consolidation of concrete in accordance with ACI 309R.

6. Do not use vibrators to move fresh concrete laterally inside forms from discharge point; shift discharge point as needed.
7. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine.
8. Place vibrators to rapidly penetrate placed layer and at least 6" (150mm) into preceding layer.
9. Do not insert vibrators into lower layers of concrete that have begun to set.
10. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
11. Do not vibrate Self-Consolidating Concrete (SCC).

E. Placing Concrete Slabs:

1. Place concrete continuously without interruption between predetermined construction and contraction joints in floors.

    a) Place slabs on grade by the long strip cast method. Refer to ACI 302.1R for recommended methods of placement.

2. Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.
3. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
4. Bring slab surfaces to correct level with a straightedge and strike off.

    a) Use highway straight edges, bullfloats or darbies to smooth surface free of humps or hollows.
    b) Do not disturb slab surfaces prior to beginning finishing operations.

5. Maintain reinforcing in proper position on chairs during concrete placement.
6. Do not place materials on slabs or impose loads during period of setting.

F. Placing Concrete on Steel Decks

1. Exercise care during concrete placement on steel decks to prevent concentrated loads or high pile-ups of concrete and to avoid impacts caused by dumping or dropping of concrete on steel decks.
2. Do not use buggies on unprotected areas of deck. If buggies are used to place concrete, furnish and install planked runways to protect deck from damage.

G. Placing Concrete at Construction Joints:

1. To secure full bond at construction joints, surfaces to receive concrete in a subsequent placement shall be left in a roughened state or intentionally roughened by raking while plastic or brushing and chipping immediately after removal.
2. Before new concrete is placed in contact, surfaces of hardened concrete already placed shall be thoroughly cleaned of foreign materials and laitance.
3. At hardened concrete at joints where no bonding agents are used, dampen concrete to achieve a saturated surface dry condition. Leave no standing water. Place and vibrate concrete (slump 7 inches (180mm) or greater) against horizontal joints. Place and vibrate flowing concrete (slump 8 to 10 inches (200 to 250mm)) while maintaining pressure against vertical joints by confinement.
4. At hardened concrete with joints not meeting conditions required for no bonding agents, apply appropriate specified bonding agent for conditions present including age and moisture per manufacturer's specifications. Place new concrete while the bonding agent is still tacky.

H. Floor Topping Slabs:

1. Place concrete topping slab to required lines and levels.
2. Minimum topping slab thickness is 2" (50mm).
3. Place dividers, edge strips and other items to be cast in place.
4. At all topping slabs, remove deleterious material before placing topping slab.
5. All topping slabs shall be bonded unless noted as unbonded on the drawings.
6. Bonded topping slabs should be placed directly against a properly prepared base slab. Proper preparation of the base slab consists of cleaning and removal of all deleterious material roughening the surface to a concrete surface profile of CSP5 or CSP6 and overnight prewetting of the newly cleaned, exposed surface with no standing water present. The surface abrasion method should not cause micro cracking of the top of the base slab.
7. Immediately before placing the bonded topping slab, scrub an even, 1/16" to 1/8" layer of portland cement/sand/water bonding grout over the entire surface to receive the topping slab. Do no allow the bonding grout to dry to a whitish appearance before the topping slab is placed.
8. Where topping slab is noted on Drawings as unbonded the topping should be placed on bond breaker consisting of two sheets of plastic film.
9. Topping mix shall have a maximum water/cement ratio of 0.45.
10. Topping mix shall have a maximum shrinkage of 0.04% at 28 days. If the topping slab is to be exposed and polished, the maximum shrinkage shall be 0.02%.
11. The topping mix shall contain a minimum of 4 lbs. per cubic yard (2.4 kg/m3) of macro synthetic fibers. **The fibers shall provide a minimum equivalent flexural residual strength (fe_3) of 150 psi (1.0 MPa) measured in accordance with ASTM C1609.** unless a higher dosage is noted on the plans.
12. The topping slab shall be moist cured for a minimum of 36 hours after placement.
13. Bonded topping slabs shall have contraction joints located to match any joints in the base slab. All topping slabs shall be jointed to eliminate restraint conditions such as re-entrant corners and to isolate the slab from columns, walls, etc. and to limit the maximum distance between joints to 15 feet (4570mm).

I. Cold-Weather Placement:

1. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306R and as specified in this section.
2. When air temperature has fallen to or is expected to fall below 40°F (4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C), and not more than 80°F (27°C), at point of placement.
3. Do not use frozen materials or materials containing ice or snow.

    a) Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

4. Remove frost, snow and ice from forms, reinforcement and other embedments immediately prior to concrete placement.
5. Use only the specified non-corrosive accelerating admixture previously approved as part of the cold weather mixture. Addition of calcium chloride, salt, thiocyanates or admixtures containing more than 0.05 percent chloride ions is not permitted.
6. Freeze Resistant Concrete per ASTM C1622 and Chapter 9 of ACI 212.3R may be used if approved by SER. The contractor shall prepare a plan for placing, finishing and curing procedures that assure the specified hardened properties are achieved.

J. Hot-Weather Placement:

1. Hot weather is defined as air temperature which exceeds 90°F (32°C) or any combination of high temperature, low humidity and/or high wind velocity which causes a rate of evaporation in excess of 0.2 pounds per square feet per hour (1.0 kg/m² per hour) as determined by ACI 305R.
2. When hot weather conditions exist that would impair quality and strength of concrete, place concrete in compliance with ACI 305R and as specified in this section.
3. Cool ingredients before mixing to maintain concrete temperature at time of placement below 95°F (35°C).
4. Mixing water may be chilled, or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.
5. Use of liquid nitrogen to cool concrete is Contractor's option.
6. When concrete placement will occur late in the day and reinforcing steel will be heated by the sun, cover reinforcing steel with water-soaked burlap so that steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
7. When concrete operations must be performed in direct sun, wind, high temperatures, low relative humidity, or other adverse placing conditions, the specified evaporation retarder shall be applied one or more times during the finishing operation to prevent plastic cracking.

3.6 CONCRETE FINISHES

A. General:

1. Comply with recommendations for concrete finishing established by ACI 302.1R and ACI 304R.
2. Comply with dimensional tolerance limitations given by ACI 117.
3. For shored floor or slab on grade construction: Floor flatness/floor levelness tolerance compliance testing is to be performed prior to the removal of shores and forms but not later than 72 hours of concrete placement by Testing Agency.
4. See architectural Drawings for locations of the various finishes listed below.
5. Comply with the specified overall SOF_F and SOF_L values listed below:

    a) The specified overall area shall be each individual floor.
    b) F_F/F_L shall be measured in accordance with ASTM E 1155.
    c) The specified minimum local values of MLF_F/MLF_L shall be 3/5 of the SOF_F/SOF_L values listed below.
    d) If an individual test section measures less than either of the specified minimum local MLF_F/ MLF_L numbers, that section may be rejected and remedial measures may be required as specified in CONCRETE SURFACE REPAIRS.
    e) If the composite value of the test surface measures less than either of the specified overall SOF_F/SOF_L numbers, then the entire slab may be rejected and remedial measures may be required.
    f) F_L numbers shall only apply to supported slabs if the tested with all of the original shoring in place, prior to shoring removal/reshoring.
    g) F_L numbers shall not apply to unshored slabs or shored slabs with camber.

B. Finish for monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile and other bonded applied cementitious finish flooring material, as indicated on architectural Drawings:

1. Scratch Finish.

    a) Finish surface to overall value of SOF_F=20 and SOF_L=15.
    b) Slope surfaces uniformly to drains where required.
    c) After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

C. Finish for monolithic slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, sand-bed terrazzo as indicated on architectural Drawings:

1. Float Finish.

    a) After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating.

b) Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both.
c) Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units.
d) Finish surfaces to overall value of SOF_F=20 and SOF_L=15.
e) Cut down high spots and fill low spots.
f) Uniformly slope surfaces to drains.
g) Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

D. Finishes for Pedestrian Sidewalks and Ramps, Exterior Platforms, Steps, as indicated on architectural Drawings:

1. Sidewalks and Curbs: Light-to-medium broom finish applied with fiber-bristle broom perpendicular to direction of main traffic route immediately after float finishing.
2. Ramps: Scored finish as applied perpendicular to direction of main traffic route immediately after float finishing.
3. Finish surface to overall value of SOF_F=20 and SOF_L=15.
4. Texture shall be approved by the Design Professionals from sample panels.

E. Finish for interior floor slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, paint or another thin film-finish coating system, as indicated on architectural Drawings:

1. Trowel Finish.

a) After floating, begin first trowel-finish operation using a power-driven trowel.
b) Begin final troweling when surface produces a ringing sound as trowel is moved over surface.
c) The final hand-troweling operation shall result in a smooth surface, free of trowel marks, uniform in texture and appearance.
d) Grind smooth any surface defects that would telegraph through applied floor covering system.

2. Finish surface to overall value of SOF_F=25 and SOF_L=20.
3. Floor Slopes: Where drains occur, slope floor slabs uniformly to drains, maintaining scheduled slab thickness.
4. Floor Edges at Expansion Joints: Tool edges minimum 3/8" (10mm).
5. Defects: Remove defects of sufficient magnitude to show through floor covering by grinding.
6. Floor Hardener: Use only where scheduled and in accordance with manufacturer's published instructions.
7. Dry Cement: Shall not be used during finishing.

F. Finish for thin set ceramic tile or thin set epoxy terrazzo, as indicated on architectural Drawings:

1. Trowel and Fine Broom Finish:

    a) Apply a trowel finish as specified.
    b) Immediately follow by slightly scarifying the surface with a fine broom.

2. Finish surface to overall value of SOF_F=35 and SOF_L=25.

G. Finishes for Parking Garage Deck, Ramps, Loading Docks:

1. Highway straight edge immediately after screeding concrete.
2. Finish surface to overall values of SOF_F=20 and SOF_L=15.
3. For Slabs Not Receiving Deck Coating: Medium broom finish with ridges not to exceed 1/8" (3mm) in height. Texture shall be as approved by the Design Professionals from sample panels.
4. For Slabs Scheduled to Receive Deck Coating: Smooth floated finish which must be verified with coating manufacturer before finishing the slab.

    a) Coordinate with deck coating specified in Division 7.

5. Auto Ramps: Rough texture applied perpendicular to direction of traffic. Texture shall be as approved by the Design Professionals from sample panels.

H. Finishes Equipment and Housekeeping Pads

1. Coordinate finish surface to meet equipment manufacturer requirements, if any, for flatness and levelness.

I. Tolerances at Slab Discontinuities

1. Within 2 ft (600mm) of slab boundaries, construction joints, isolation joints, block-outs, penetrations or other similar discontinuities, where required for travel paths, installation of finishes and partitions, or any other requirements indicated in the Contract Documents, the following equivalent straightedge tolerances shall apply:

    a) Specified local MLF_F = 12, use ¼” (6mm) over 4 ft (1200mm), no offset greater than 1/16” (2mm)
    b) Specified local MLF_F = 15, use 1/8” (3mm) over 4 ft (1200mm), no offset greater than 1/32” (0.8mm)

J. Dry Shake Finish:

1. Non-slip aggregate where indicated on Drawings.
2. Non-oxidizing metallic hardener on loading docks at a rate of 1.5 lbs. per sq. ft. (7.3 kg/m²) and in other locations so noted on the Drawings.
3. Mineral aggregate hardener at a rate of 1.2 lbs. per sq. ft. (5.8 kg/m²) where noted on the Drawings.
4. Final finish type, method and tolerance as applicable by location and use.
5. Dry shake finish will be applied only where scheduled and in accordance with the manufacturer's published instructions and the methods and procedures agreed upon at the pre-installation conference.

K. Rough Formed Finish:

1. Acceptable for formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated.
2. Concrete surface shall have texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4" (6mm) in height rubbed down or chipped off.

L. Architectural Concrete Finish:

1. Using self-consolidating concrete, provide smooth, uniform finish upon form removal with no patching, stoning or other form of repair except washing permitted unless otherwise noted for walls, columns and other surfaces exposed to view. The surface shall match the approved jobsite mock-up panel.

M. Smooth Formed Finish:

1. Required for formed concrete surfaces exposed to view, or scheduled to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system, as indicated on architectural Drawings:
2. Surface is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
3. Repair and patch tie holes and defects. Remove fins and other projections completely.

N. Smooth Rubbed Finish:

1. "Smooth Rubbed" finish shall consist of a finish free of fins, joint marks smoothed off, blemishes removed and surfaces left smooth and unmarred.
2. Provide smooth rubbed finish to scheduled concrete surfaces, as indicated on architectural Drawings, which have received smooth form finish treatment not later than one day after form removal.
3. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced.

    a) Do not apply cement grout other than that created by the rubbing process.

O. Grout-Cleaned Finish:

1. Provide grout-cleaned finish on scheduled concrete surfaces, as indicated on architectural Drawings, that have received smooth-formed finish treatment.
2. Combine one part Portland Cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint.

3. Blend standard Portland Cement and white Portland Cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
4. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes.
5. Remove excess grout by scraping and rubbing with clean burlap.
6. Keep surface damp by fog spray for at least 36 hours after rubbing.

P. Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.7 CURING AND PROTECTION

A. Normal Conditions:

1. Protect concrete from premature drying, excessive hot or cold temperature, and damage.
2. Concrete shall be kept continuously moist and above 50°F (10°C) for seven days (ASTM C 150 Type I cement) or for 10 days (ASTM C 150 Type II cement). High early strength concrete usage shall be maintained over 50°F (10°C) for three days.
3. Concrete and concrete patching materials shall be cured according to manufacturers published recommendations.
4. Begin curing as soon as free water has disappeared from concrete surface and finishing has been completed.
5. Curing Methods: Cure concrete by curing compound, moist curing, moisture-retaining cover curing, or by combining these methods, as specified. Under extreme hot/dry or windy/dry conditions, moist curing and/or moisture-retaining cover curing should be used.

a) Curing compound is an acceptable form of curing if all of the following requirements are met:

i. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). In accordance with all manufacturer’s instructions.
ii. Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions.
iii. Recoat areas subjected to heavy rainfall within 3 hours after initial application.
iv. Maintain continuity of coating and repair damage during curing period.
v. Use curing and sealing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

vi. Floors to receive covering shall be cleaned thoroughly using a power scrubber and industrial strength detergent. Hand-brooming and sweeping is not sufficient.
vii. Strippable curing compound may be used in lieu of a moist curing method when approved by the Design Professionals.

b) Provide moist curing by the following methods:

i. Keep concrete surface continuously wet by covering with water.
ii. Use continuous water-fog spray.
iii. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4" (100mm) lap over adjacent absorptive covers.

c) Provide moisture-retaining cover curing as follows:

i. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" (75mm) and sealed by waterproof tape or adhesive.

(1) Immediately repair any holes or tears during curing period using cover material and waterproof tape

6. Cure slabs on grade, concrete toppings, concrete pour strips, supported slabs, walls and columns, not subject to conditions of hot or cold weather concreting, in accordance with ACI 308.
7. Cure surfaces exposed to deicing salts, brackish water, etc., such as loading dock slabs, parking garage slabs and ramps in accordance with ACI 308 recommendations for moist curing.
8. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by leaving forms in place for the full curing period (equivalent to moist curing).

a) If forms are removed prior to completion of full curing period, continue curing by methods specified above for Unformed Surfaces, as applicable.

B. Cold-Weather Protection:

1. When concrete is placed under conditions of cold weather concreting (defined as a period when the mean daily temperature drops below 40°F (4°C) for more than 3 successive days), take additional precautions as specified in ACI 306R when placing, curing, monitoring and protecting the fresh concrete.

C. Hot-Weather Protection:

1. When concrete is placed under conditions of hot weather concreting, provide extra protection of the concrete against excessive placement temperatures and

excessive drying throughout the placing and curing operations with an evaporation retarder.

a) Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

2. Hot weather curing is required if hot weather conditions occur within a 24-hour period after completion of concrete placement.

D. Floor surfaces, wherever indicated by weather conditions, shall be sprinkled during the interval between finishing operation and the start of curing to positively ensure against the possibility of surface drying.

3.8 CONCRETE REPAIRS

A. Perform patching and repairs in accordance with ACI 301.

B. Contractor shall submit patching and repair methods and materials for review by Design Professionals.

C. When complete, all patches and repairs shall match color and texture of adjoining surfaces.

D. At surfaces that are exposed to view, prepare test areas at inconspicuous locations for review by Design Professionals to verify repair color and texture match before proceeding with repair.

E. Apply all patching and repair materials in accordance with manufacturer's specifications.

F. Repairing Cracks In Formed and Unformed Surfaces:

1. Contractor shall notify Design Professionals of all cracks wider than 0.02" (0.50mm) and all cracks wider than 0.01" (0.25mm) that occur in a group of at least three cracks within twelve inches (300mm), in concrete. If Design Professionals deem repairs necessary, Contractor shall be responsible for repairing all such cracks per Design Professionals recommendation at no expense to the Owner. Repairs will generally require one or more of the following: Epoxy Injection, Semi-Rigid Epoxy, Pressure Injected Foam Resin, Methyl Methacrylate and/or Sealant with joint routed and cleaned. See Concrete Repair Materials section of this Specification for acceptable products

G. Repairing Formed Surfaces

1. Immediately after stripping forms, patch all honeycombing, defective joints, voids, etc. before the concrete is thoroughly dry.
2. Remove all burrs, fins, and ridges before the concrete is thoroughly dry.
3. Remove stains from rust, grease and oils, from release agents, etc.
4. Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Design Professionals.

a) Surface defects, include color and texture irregularities, cracks as defined above, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
b) Chip away defective areas, honeycomb, rock pockets, voids over 1/4" (6mm) in any dimension and holes left by tie rods and bolts, down to solid concrete but in no case to a depth less than 1" (25mm) and saw-cut edges to prevent feather edging of fill material.

5. Repair concealed formed surfaces, where possible, containing defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
6. Clean out form tie holes and fill with dry pack mortar or precast cone plugs secured in place with bonding agent.
7. If honeycombing exposes reinforcement, chip to provide clear space at least 3/4" (20mm) wide all around steel to allow proper bond.

H. Repairing Unformed Surfaces:

1. High and Low areas in concrete surfaces which are in excess of specified tolerances shall be leveled or ground-smooth.

a) Correct high areas by grinding after concrete has cured at least 14 days.
b) Correct low areas by applying leveling material. Finish leveling material as specified in this section.

2. Repair surfaces containing defects that affect durability of concrete.

a) Surface defects include crazing, cracks as defined above, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

3. Repair defective areas, except random cracks and single holes not exceeding 1" (25mm) in diameter, by cutting out and replacing with fresh concrete.

a) Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4" (20mm) clearance all around.

I. Filling In: Fill in holes and openings left in concrete for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place.

3.9 EVALUATION AND ACCEPTANCE OF CONCRETE

A. In accordance with ACI 301, except where otherwise specified.

B. If, at any time during construction, the concrete resulting from the approved mix design deviates from Specification requirements for any reason, such as lack of workability, or insufficient strength, the Contractor shall have his laboratory verify the deficiency and modify the mix design, until the specified concrete is obtained. Modified mix to be submitted for approval per Part 1 - SUBMITTALS.

3.10 CORRECTIVE MEASURES

A. Conflicts: The Contractor shall be solely responsible for errors of detailing, fabrication, and placement of reinforcement steel; placement of inserts and other embedded items; and the structural adequacy of all formwork.

B. Compensation for Additional Services: Should additional work by Design Professionals such as design, documentation, meetings and/or site visits be required which are necessitated by failure of the Contractor to perform the work in accordance with the Contract Documents either developing corrective actions or reviewing corrective actions developed by others, the Contractor is responsible for paying for additional work performed by the Design Professionals at their standard firm-wide billing rates plus out-of-pocket expenses incurred at cost + 10%. Additional costs for testing and inspection by the Owner shall also be compensated by the Contractor.

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CONCRETE MIX DESIGN SUBMITTAL FORM

Project: _____

City: _____

General Contractor: _____

Concrete Contractor: _____

Concrete Strength: _____

Use/Location on Job: _____

Supplier's Mix Designation: _____

Design Mix Information	**(Please check one):**	*Refer to ACI 301 for requirements of data used to substantiate strength calculations.*
Field Experience (Based on Standard Deviation Analysis):	_____	
Trial Mixture Test Data:	_____	

Design Characteristics:

Density:	_____	Pcf (kg/m3)
Strength:	_____	Psi (MPa) (28 day)
Air:	_____	% (specified)

Materials:	**Type/Source**	**Specific Gravity**	**Weight (lb)**	**Absolute Vol. (cu. ft.) (cu. m)**
Cement:				
Fly ash:				
Slag (GGBFS)				
Microsilica:				
Coarse Aggregate:				
Fine Aggregate:				
Water:				
Air:				
Other:				
TOTAL:				27.0 cu. ft. (1.0 m3)
Water/Cementitious Material Ratio (lbs. (kg) water / lbs. (kg) cementitious material) =				%

Admixtures:	**Manufacturer**	**ASTM**	**Dosage (oz/cwt)**
Water Reducer:			
Air Entraining Agent:			
High Range Water Reducer			
Non-corrosive Accelerator:			
Other:			

Slump before HRWR: _____ Inches (mm)
Slump after HRWR: _____ Inches (mm)

Standard Deviation Analysis (from experience records):

No. of Test Cylinders Evaluated: _____
Standard Deviation: _____

Required Average Strength f'cr
Average Strength by Tests
Equation Used (ACI Chapter 5)
(Refer to ACI 318 for increased deviation factor when less than 30 tests are available)

TRIAL MIXTURE TEST DATA

Compressive Strength:	**Age (days)**	**Mix #1**	**Mix #2**	**Mix #3**
	28 [56] [90]	psi (MPa)	psi (MPa)	psi (MPa)
	28 [56] [90]	psi (MPa)	psi (MPa)	psi (MPa)
	28 [56] [90]	psi (MPa)	psi (MPa)	psi (MPa)
	Average	psi (MPa)	psi (MPa)	psi (MPa)
Required Average Strength f'cr				
Average Strength by Tests				
Equation Used (ACI Chapter 5)				

REQUIRED ATTACHMENTS	***Please check***
Coarse Aggregate Gradation Report	
Fine Aggregate Gradation Report	
Fly Ash (or other Supplementary Cementitious Material) Certification	
Concrete Compressive Strength Data or Trial Mixture Test Data	
Admixture Compatibility certification letters	
Chloride Ion Content Certification	
Alkali Aggregate Reactivity Certification	
Shrinkage Test Reports	

SUBMITTED BY:

Name: _____

Address: _____

_____

Phone no.: _____

Main Plant Location: _____

Miles from Project: _____

Secondary Plant Location: _____

Miles from Project: _____

_____

Date: _____

Certification by Concrete Supplier:
Signature: _____

Print Name:

_____

PE License Number and Expiration Date (print or stamp) _____

Structural Substitution Request Form – to be completed by Contractor

Project:		Substitution Request #
Date:		
Requesting Contractor:		Pages Attached (including this form)

1. Description of Requested Substitution:

2. Related Drawings and Specification Sections:

3. Rationale or Benefit Anticipated:

4. Effect on Construction Schedule[1] (check one): ☐ NONE ☐ See Attached

5. Effect on Owner's Cost[2] attach data (check one): ☐ CREDIT TO OWNER ☐ EXTRA

6. Effect on Construction Documents[3] (design work anticipated): ☐ NONE ☐ See Attached

7. Requesting Contractor Agrees to Pay for Design Changes (check): ☐ YES ☐ NO ☐ NOT APPLICABLE

8. Effect on Other Trades[4]:

9. Effect of Substitution on Manufacturer's Warranty (check): ☐ NONE ☐ See Attachment

Signature[5]: Date:

Company:

General Contractor Signature[5]: Date:

Notes:

1. Contractor is responsible for means and methods and any problems that may arise from making the requested substitution.
2. This is **NOT A CHANGE ORDER FORM**. A separate form is required to adjust costs and/or schedules.
3. Contractor is responsible for any design impacts that may arise from this substitution, including redesign efforts.
4. Contractor is responsible for effects on other trades from this substitution;
   General Contractor must review and agree effects on other trades are fairly represented in items 4-9.
5. Signature by a person having authority to legally bind his/her company to the above terms. Otherwise this request is void
6. All items in form must be completed for substitution request to be considered.

Request Review Responses (completed by Architect and/or Engineer(s)):

ACCEPTED	ACCEPTED AS NOTED	REJECTED	INSUFFICIENT DATA TO SUPPORT REQUEST	ENGINEER / ARCH / MEP SIGNATURE	DATE

Engineer/Architect Comments:

END OF SECTION

SECTION 05 12 00 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 GENERAL

Work of this Section shall conform to requirements of Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections.

1.2 SCOPE

The work covered by this Section shall include all labor, material, equipment, permits, engineering and other services necessary for the fabrication and installation of structural steel and related work, complete, in accordance with the Drawings and as specified herein.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Quality Assurance: Structural Testing and Inspection	Section 01 45 00
Concrete Reinforcement and Embedded Assemblies	Section 03 20 00
Cast-In-Place Concrete	Section 03 30 00
Steel Joists	Section 05 20 00
Steel Deck	Section 05 30 00
Cold-Formed Metal Framing	Section 05 40 00
Miscellaneous Metals	Division 5
Fireproofing	Division 7
Painting	Division 9
Elevators	Division 14

1.4 CODES AND STANDARDS

A. Building Code: Structural steel work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards:

1. American Institute of Steel Construction (ANSI/AISC 360) "Specification for Structural Steel Buildings" per Structural General Notes.
2. ANSI/AISC 341 and 341s1- Seismic Provisions for Structural Steel Buildings, Including Supplement No. 1; American Institute of Steel Construction, Inc.

    a) Item J2.1.1 shall be deleted, and replaced by the requirements of the project Specification

3. American Institute of Steel Construction (AISC 303), "Code of Standard Practice" (COSP). Due to potential conflicts between the governing contracts and parts of Section 1 through 5 of the COSP, Sections 1 through 5 are excluded

from these Contract Documents. Prior to bid, the Owner and Contractor, in consultation with the Design Professionals, can discuss and determine if any excluded provisions are appropriate to include in the Contract Documents.

4. American Welding Society, AWS D1.1, "Structural Welding Code".
5. Research Council on Structural Connections (RCSC) - "Specification for Structural Joints Using High Strength Bolts".
6. American Society for Testing and Materials "ASTM Standards in Building Codes", various standards as referenced herein.
7. The Society for Protective Coatings (formerly Steel Structures Painting Council, "SSPC") "Steel Structures Painting Manual".

C. Definitions:

1. The term "Contract Documents" in this Specification is defined as the design Drawings and the Specifications.
2. The term "SER" in this Specification is defined as the Structural Engineer of Record for the structure in its final condition.
3. The term "Design Professionals" in this Specification is defined as the Owner's Architect and SER.
4. The term "Contractor" in this Specification is defined to include any of the following: General Contractor and their sub-contractors, Construction Manager, Structural Steel Fabricator or Structural Steel Erector.
5. The term "Heavy Sections" in this Specification is defined to include hot rolled steel shapes with flanges exceeding 2 inches (50mm) in thickness and built up cross sections with plates exceeding 2 inches (50mm) in total thickness.
6. The term "High Restraint Weld" describes welds in which there is almost no freedom of movement for members joined due to geometry or material thickness.
7. The term "Testing Agency" in this Specification is defined as an independent testing and inspection service engaged by the Owner for quality assurance testing and inspection of structural construction in accordance with applicable building code provisions and any additional activities listed in the Contract Documents.
8. The terms "for record" and "submit for record" in this Specification are defined as Contractor submittals that do not require a response from the Design Professionals.
9. The term "Working Days" in this Specification is defined as Monday through Friday, except for federal or state holidays.
10. The term "Delegated Design" in this Specification is defined as a scope of work that meets performance and design criteria established in the Contract Documents and is to be completed by the Contractor's licensed engineer.

1.5 CONTRACTOR QUALIFICATIONS

A. Qualification Data: Submit for record qualification data (personnel and firm resumes, and project lists with references) for the Structural Steel Fabricator ("Fabricator"), Structural Steel Detailer ("Detailer"), Contractor's Engineer(s) and Structural Steel Erector ("Erector").

B. The Fabricator shall have 10 years of comparable experience in installations of this type and shall employ labor and supervisory personnel familiar with the type of installation, experienced in fabrication and erection of structural steel for projects of similar size and

complexity. At the time of bid the Fabricator shall be AISC certified to the Standard for Steel Building Structures (BU) and must submit proof of these qualifications. The Fabricator's qualifications shall be subject to review by the Design Professionals and Owner.

C. The Detailer shall have 10 years experience preparing detailed steel shop drawings and CNC downloads for structures of this type and complexity. The detailer's qualifications shall be subject to review by the Design Professionals and Owner.

D. The Contractor's Engineer(s) shall be qualified to perform the type of work required by the project. The Engineer shall be a Professional Engineer licensed in the state where the project is located. The Contractor's Engineer(s) shall have 10 years of experience being in responsible charge of work of this nature. The proposed Engineer(s) shall be subject to approval of Design Professionals and Owner.

E. The Erector shall have 10 years of successful experience erecting structural steel for structures of this type and complexity in the region of the project. At the time of bid the Erector shall be an AISC Certified Steel Erector (CSE) and must submit documentation of this qualification.

F. Welding: Qualify the welding procedures, shop welders, field welders, welding operators and tackers in accordance with AWS D1.1 and for the following periods of effectiveness of certification:

1. Certification and qualification, including period of effectiveness of welding personnel shall be as specified by AWS D1.1. Certification shall remain in effect for duration of work provided welders are continuously engaged in performing the type of welding for which they are certified, unless welders fail to perform acceptable welding, as determined by the Testing Agency. Certification and re-certification of welding personnel is subject to verification by the Testing Agency. Re-testing for re-certification will be the Contractor's responsibility.

1.6 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested. Reproduction of structural drawings for shop drawings is not permitted. Building Information Models for contractor's use may be provided as mutually agreed upon by Design Professionals.

(1) Submittal Schedule
(2) Calculations, Shop Drawings and Erection Drawings
(3) Submittal Letters
(4) Pre-construction Survey
(5) Quality Control Program
(6) Product Data
(7) Samples
(8) Welding Procedures Specification (WPS)
(9) Welder Certifications

(10) Mill Reports
(11) As-built surveys

Submittal Schedule: The contractor shall submit for action a typical connection design calculation and shop drawing submission schedule at least twenty (20) working days prior to commencing submission of connection design calculations and shop drawings.

a) This schedule shall include a list, in order of date to be submitted, of all drawings and other required submittal items scheduled to be submitted. The schedule shall list the proposed submittals for each week, including but not limited to the number of calculation sheets, erection drawings, and piece drawings, as well as their formats. Once shop drawing submissions have commenced any modification or addition to this schedule must be submitted for action at least twenty (20) working days before the modification or addition is proposed to take place.

b) If at any time the total number of connection design calculations, erection drawings and shop drawings received in any one week period exceeds the amount in the approved schedule by more than 10% for that week, the Design Professionals have the right to add two days to the average turnaround time for each 20% increment in excess of the scheduled quantity for that week's submissions. For example if the weekly total exceeds the schedule by 10% to 20%, two days may be added; if it is exceeded by 21% to 40%, four days may be added. The return dates for subsequent submittals may be extended based on the additional review time stated above.

c) For the purposes of developing a schedule, assume the following review rates:
Calculations – 100 – 8 ½' x 11" sheets per week
Shop drawings – 300 pieces per week

2. Calculations, Shop Drawings and Erection Drawings (including Field Work drawings): Submit for action required connection calculations, shop drawings and erection drawings for all structural steel indicated on the Contract Documents.

a) Material shall not be fabricated or delivered before the shop and erection drawings have been approved or approved as noted by the Design Professionals and returned to the Contractor.

b) Connection design calculations: Calculations are required for all details that are not indicated on the Drawings as "Completely Designed." Each calculation package shall be sealed and signed by the Contractor's Engineer.

c) Structural Steel Shop Drawings: Submitted shop drawings shall include layouts and details for each member showing the steel type and grade, size, connections, cuts, copes, holes, bolts, welds, surface treatments (cleaning, shop paint, etc.) and provisions for the connection of other work. Steel type, grade and size for all attached elements shall also be shown.

d) Shop and erection drawings shall contain complete dimensional and geometric information, based on established dimensions shown on Contract Documents, and shall not be scaled from Contract Documents. The shop drawings shall clearly distinguish between shop and field welds and bolts, identify pretensioned high strength bolts and identify surface preparation requirements at slip critical connections.

e) Welds: All welds shall be indicated by standard welding symbols in the "Standard Code for Arc and Gas Welding in Building Construction" or as accepted by the SER. Shop and erection drawings shall show the size, length, and type of each weld, including the electrode type to be used.

f) Bolts: Details for bolt assemblies shall indicate bolt size, length, type and the presence, type and location of washers where required as part of the assembly; distinguish between N and X bolts, distinguish between slip-critical and bearing bolts; specify approved slip critical coatings; and distinguish between shop and field bolts. Also, indicate bolt orientation where required by the Contract Documents.

g) Erection Drawings: The erection drawings shall include plans showing exact locations of base and bearing plates, and/or anchor rods and other embedded items. All field connections not specifically shown on shop drawings shall be shown on erection drawings, including field bolt size, type, number, location and any special installation requirements, and field weld size, type, length and location.

3. Submittal Letters: The Contractor shall submit for record letters from the Contractor's Engineer supervising the preparation of connection designs on shop and erection drawings.

a) A letter shall be submitted along with the first submission of Connection design calculations. It shall be sealed and signed by the Contractor's Engineer, and shall include the following:

"All Connection design calculations for this project have been developed, and all details and connections for this project will be designed, by me, or by qualified personnel under my direct supervision, to resist the loads and reactions indicated on the Contract Documents, except for those connections which are designated as completely designed on the Contract Drawings."

b) A second letter shall be submitted upon the satisfactory submission, review and/or approval of all shop and erection drawings. It shall be sealed and signed by the Contractor's Engineer and include the following:

"All details and connections as shown on the final shop and erection drawings for this project have been designed by me, or by qualified personnel under my direct supervision, to resist the loads and reactions indicated on the Contract Documents, except for those connections which are designated as completely designed on the Contract Drawings."

4. Preconstruction Survey: Submit for record. Where interface with existing construction occurs, before related shop drawings are prepared survey the existing construction and submit the survey prepared by a professional surveyor employed by the Contractor to the Design Professionals. For all steel construction, before steel erection commences, perform and submit to the Design Professionals a complete survey for position and alignment at all points where construction by other trades will support steel elements, including but not limited to pockets, embedded plates, anchor rods and base plates. Include plan location positions relative to the building gridlines and elevations of bearing surfaces and tops of bolts relative to building Datum elevation. Immediately notify the SER of elements that are not within tolerance.
5. Quality Control Program: Submit for record complete details of the Contractor's quality control program including the names of the personnel responsible for this work.
6. Product Data: Submit for action manufacturers' specifications, test reports and applicable standards for all products listed under Part 2: Products. Standard literature shall be edited to suit job conditions.
7. Samples: Submit for record (2) samples each, (2) of shop painted products and (2) of field touch-up painted products. Samples shall be steel material.
8. Welding Procedures: Submit for record all Welding Procedure Specifications (WPS) and Procedure Qualification Records (PQR):

    a) All Welding Procedures shall be Signed and Sealed by the Contractor's Engineer or Certified Welding Engineer, confirming all essential variables meet design requirements as applicable on the Contract Documents and weld electrode manufacturer's recommendations.
    b) The Contractor's Engineer or Certified Welding Engineer shall develop all Special Welding Procedures for Heavy Sections and High Restraint Welds. Special Procedures shall be Signed and Sealed by the Contractor's Engineer or Certified Welding Engineer. Use of AWS D1.1, Annex E forms are recommended for Special Procedure submittals.

9. Welder Certification: Submit for record certification that the welders have passed qualification tests acceptable to the governing authority using AWS procedures.

    a) A certification shall be submitted in standard AWS format.
    b) Each certification shall state that the welder has been doing satisfactory welding of the required type within the six-month period prior to the subject work.

    For any welder whose period of certification effectiveness has lapsed or whose workmanship is subject to question in the opinion of the Design Professionals or Testing Agency, immediate testing for recertification will be required. Tests, when required, shall be conducted at the sole expense of the Contractor.
10. Mill Reports: Submit for record certified copies of all mill reports to the Design Professionals and to the Testing Agency, covering the chemical and physical

properties of all structural steel and accessories (as defined in this Specification) for the project.

a) Such certificates shall be obtained from the mills producing the steel and shall certify in a cover letter submitted with the certificates, that the steel meets the minimum requirements as to physical properties, inspection, marking and tests for structural steel as defined by the current edition of the relevant ASTM Standard Specifications. Any steel that does not meet the ASTM requirements must be clearly identified in a cover letter submitted with the certificates.

b) Prior to commencing steel erection, the contractor shall deliver certificates to the Owner in number and form as may be required by the local Building Department or other local and State agencies having jurisdiction.

11. As-Built Surveys: Execute and submit for record a comprehensive survey of steel structure at each level adequate to assess if the structure has been built within the tolerances specified in the Contract Documents. Each certified survey, performed by a professional surveyor employed by the Contractor, shall be submitted to the Contractor's Engineer for their approval before proceeding to the next stage of erection. If deviations from the tolerances are discovered, the Contractor shall present corrective measures to the Design Professionals within 48 hours of completion of that stage of erection. Upon completion of steel erection, submit the complete package of steel surveys for record to the Design Professionals and the Owner.

B. Submittal Process

1. Submittal of shop and erection drawings and other submittals by the Contractor shall constitute Contractor's representation that the Contractor has verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each drawing with other Drawings and other trades. The Contractor shall place their shop drawing stamp on all submittals confirming the above.
2. Connection design calculations: Calculations are required for all details that are not indicated on the Drawings as "Completely Designed." The Contractor shall submit connection design calculations and receive an action of approval prior to submitting shop drawings related to those calculations. The shop drawings shall incorporate all comments provided on the calculations.
3. Shop and erection drawings: Submit in complete packages so that individual parts and the assembled unit may be reviewed together. This Specification Section and the applicable drawings used in the development of the shop and erection drawings shall be referenced on each shop and erection drawing to facilitate checking. Unless the piece marks are self-indexing, furnish index sheets with the shop drawings, relating piece marks for all beam, girder and column details to the sheet numbers on which they are located.
4. The Contractor shall submit to the Design Professionals one (1) electronic copy for shop drawing review. The naming convention of each drawing must follow

the submittal numbering system and include the submittal #, specification #, revision # and drawing # in the prefix of the drawing name.

5. The Contractor shall allow at least ten (10) working days between receipt and release by the SER for the review of shop and erection drawings and submittals other than connection design calculations. The Contractor shall allow at least fifteen (15) working days between receipt and release by the SER for the review of connection design calculations.
6. All modifications or revisions to submittals, shop drawings, connection design calculations and erection drawings must be clouded, with an appropriate revision number clearly indicated. The following shall automatically be considered cause for rejection of the modification or revision whether or not the drawing has been approved by the Design Professionals:

    a) Failure to specifically cloud modifications
    b) Failure to submit calculations for the modifications
    c) Unapproved revisions to previous submittals
    d) Unapproved departure from Contract Documents

7. The Contractor shall deliver to the Design Professionals at the completion of the job two (2) electronic versions of the final as-built shop drawings on a CD-ROM or other media acceptable to the Design Professionals.
8. Resubmittals: Completely address previous comments prior to resubmitting a drawing. Resubmit only those drawings that require resubmittal.
9. Resubmittals Compensation: The Contractor shall compensate the Design Professionals for submittals that must be reviewed more than twice due to contractors' errors. The Contractor shall compensate the Design Professionals at the standard billing rates plus out-of-pocket expenses incurred at cost + 10%.

C. SER Submittal Review

1. The review of connection design and the review and approval of shop and erection drawings and other submittals by the Design Professionals shall be for general conformance with the design intent of the work and with the information given in the Contract Documents only and will not in any way relieve the Contractor or the Contractor's Engineer from:

    a) Responsibility for the adequacy of the design of the connections designed by the Contractor's Engineer.
    b) Responsibility for all required detailing.
    c) Responsibility for the proper fitting of construction work in strict conformance with the contract requirements.
    d) The necessity of furnishing material and workmanship required by contract Drawings and Specifications which may not be indicated on the shop and erection drawings.
    e) Conforming to the Contract Documents.
    f) Coordination with other trades.
    g) Control or charge of construction means, methods, techniques, sequences or procedures, for safety precautions and programs in connection with the work.

2. TYPE 1 – Structural Submittal Review Stamp: For shop drawings for building elements designed by the SER, the responses on the shop drawing review stamp used by the SER require one of the following actions:

   a) APPROVED indicates that the SER has found that the information presented on the shop or erection drawing appears to conform to the requirements of the Contract Documents. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the Contract Documents.
   b) APPROVED AS NOTED indicates that the SER requires the shop or erection drawing to be corrected to reflect the notes and comments shown. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the notations shown on the shop drawings and the Contract Documents. Promptly resubmit the corrected shop or erection drawing for record.
   c) REVISE and RESUBMIT indicates that the SER requires resubmission of the shop or erection drawing after correction per notes and comments. None of the elements of work shown on the shop drawing shall be fabricated, manufactured or constructed until the Contractor has received a returned shop drawing marked Approved or Approved as Noted.
   d) NOT APPROVED indicates that the shop or erection drawing does not conform to the Contract Documents and must be extensively revised before re-submittal. None of the elements of work shown on the shop drawing shall be fabricated, manufactured or constructed until the Contractor has received a returned shop drawing marked Approved or Approved as Noted.

3. TYPE 2 – Delegated Design Review Stamp: For submittals for building elements which are not designed by the SER but are delegated design items, or for items that do not form part of the completed structural system but impose loads on the structure, or for construction items or activities which have an effect on the final structure. The responses on the stamp used by the SER require one of the following actions:

   a) NO EXCEPTIONS indicates that the SER has found that the information presented on the submittal appears to conform to the requirements of the Contract Documents. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the Contract Documents.
   b) EXCEPTIONS NOTED indicates that the SER requires the submittal be corrected to reflect the notes and comments shown. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the notations shown on the shop drawings and the Contract Documents. Promptly resubmit the corrected document for record.
   c) REJECTED indicates that the SER requires resubmission of the submittal after correction per notes and comments. None of the elements

of work shown on the shop drawing shall be fabricated, manufactured or constructed. Contractor to revise and resubmit until SER response of No Exceptions or Exceptions Noted is received.

D. Substitution Request

1. Requests for any departure from Contract Documents must be submitted in writing by the Contractor and accepted in writing by the Design Professionals, prior to receipt of submittals.
2. All substitutions must be requested using the structural substitution request form included at the end of this section. Acceptance using the structural substitution request form indicates acceptability of the structural concept only. Contractor must submit shop drawings reflecting accepted substitutions for review in accordance with this Specification. The structural substitution request form, even if accepted, does not constitute a change order.
3. Such substitutions or modifications, if acceptable to the Design Professionals shall be coordinated and incorporated in the work at the sole expense of the Contractor.
4. The acceptance by the Design Professionals of a specific and isolated request by the contractor to deviate from these requirements does not constitute a waiving of that requirement for other elements of, or locations in the project, unless specifically addressed as such and permitted by the Design Professionals in writing.
5. Compensation for Additional Services: Should additional work by Design Professionals such as design, documentation, meetings and/or site visits be required which are necessitated for the review and/or incorporation of the Contractor-requested substitution, including indirect effects on other portions of the work, the Contractor is responsible for paying for additional work performed by the Design Professionals at the standard billing rates plus out-of-pocket expenses incurred at cost + 10%. Additional costs for testing and inspection by the Owner shall also be compensated by the Contractor.
6. Contractor is responsible for means and methods and any impacts on other portions of the work that may arise from this substitution.

E. Request for Information (RFI)

1. RFI shall originate with the Contractor. RFI submitted by entities other than that Contractor will be returned with no response.
2. Limit RFI to one subject.
3. Submit RFI immediately upon discovery of the need for interpretation or clarification of the Contract Documents. Submit RFI within timeframe so as not to delay the Construction Schedule while allowing the full response time described below.
4. The response time for answering an RFI depends on the category in which it is assigned.

    a) Upon receipt by the SER, each RFI will be assigned to one of the following categories:

        i. No cost clarification

ii. Shown in Contract Documents
iii. Change to be issued in future bulletin
iv. Previously answered
v. Information needs to be provided by others.
vi. Request for corrective field work
vii. Request for substitution

b) RFIs in the first five categories listed above will be turned around by the SER on average of five (5) working days.
c) RFIs in the last two categories listed above will be immediately rejected and must be submitted as submittals or requests for substitution.

1.7 TEMPORARY SUPPORT OF STRUCTURAL STEEL FRAME

The structure as shown on the Contract Documents is designed to withstand the design loads only when all structural elements are installed and fully connected. The contractor shall be responsible for the analysis of all components and assemblies for stresses and displacements that may be imposed by fabrication, shipping, handling, erection, temporary conditions, construction loads, etc. The analysis of such shall be performed by the Contractor's Engineer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Unload all structural steel promptly upon arrival and store in an area designated and approved by the Owner at the site of the work. The Contractor shall be responsible for any charges from failure to unload material promptly.

B. Storage: Store structural steel to drain properly. Provide weep holes and clean out as required to keep steel free from water. Provide adequate protection and shoring to prevent distortion and other damage. Store structural steel on timber; do not lay on mud, directly on ground or cinders, or otherwise handle in a manner that damages finishes. Stored sections shall be readily accessible for inspection.

C. Store fasteners in a protected place.

D. Welding materials to be in moisture resistant, undamaged package. Maintain packages effectively sealed until electrode is required for use. Storage and handling shall be per AWS D1.1.

1.9 CONNECTION DESIGN AND DETAILING CONFERENCE

A. At least 20 working days prior to starting connection design and detailing, the Fabricator shall hold a meeting to verify all connection design assumptions and procedures and shop drawing preparation and submittal procedures.

B. The Contractor shall prepare an agenda and require responsible representatives of every party who is concerned with the connection design and detailing to attend this meeting, including but not limited to:

1. General Contractor
2. Fabricator
3. Detailer

4. Connection Engineer
5. Design Professionals
6. Erector

C. The Fabricator shall prepare an agenda prior to the meeting, and shall distribute meeting minutes to all parties within 5 working days of the meeting.

1.10 DESIGN OF CONNECTIONS

A. The contractor is responsible to design all connections not completely designed on the Contract Documents. A Completely Designed connection is only one that is specifically designated as such by the statement “COMPLETELY DESIGNED” on the Contract Documents. All connections not indicated as “COMPLETELY DESIGNED” shall be designed for the forces and/or connection design criteria called for in the Contract Documents.

B. Connection concepts shown on the Drawings that are not “COMPLETELY DESIGNED” show only the minimum requirements to convey design intent.

C. All connections and details shown on shop and erection drawings shall be prepared under the supervision of the Contractor's Engineer, in accordance with AISC "Load and Resistance Factor Design Specification for Structural Steel Buildings."

D. The contractor shall design and provide any stiffener plates, doubler plates, reinforcing plates, etc. and their connections that may be required to develop and/or transfer the forces and/or connection design criteria called for in the Contract Documents.

E. Design connections to withstand the combined effects of shears, axial forces, moments and torques and as required by applicable code(s) and the Contract Documents.

F. All forces shown on the Drawings are to be assumed reversible unless noted otherwise and must be checked for both directions. If no transfer/pass-through forces are shown on the Contract Documents, the most critical combinations of member forces and directions shall be assumed for the connection design.

G. Use types of shop and field connections shown on Contract Documents or, in absence of such indication, propose appropriate type for Design Professionals review.

H. Welding of High Restraint Welds: Use double bevels in lieu of single bevels where practical. Detail joints to allow for weld shrinkage. In cases of plates in more than one plane, show welding operation sequence on the drawings. In general, start welding at the most restrained part of the weldment and proceed to the least restrained.

I. All welded connection must utilize pre-qualified joints or joints that have been qualified by AWS D1.1, section 2.

J. Comply with all connection notes on Drawings in conjunction with these Specifications.

K. The connection design calculation submittals shall meet the following criteria:

1. Number each calculation in a logical and orderly system. Once submitted for review, calculations shall not be renumbered. Resubmitted calculations shall be indicated by using the same number with an "R" suffix. All changes must be clouded.
2. Provide sketches for results of each calculation, with all pertinent dimensions relating to the calculations (including pitch, gage, edge distance, unbraced lengths, Whitmore lengths, etc.) clearly shown. Geometry must be shown accurately and to scale. Provide enough sketches to clearly document the full range of geometric conditions applicable to each connection design calculation proposed.
3. For repetitive connections provide a spreadsheet or computer program summary table for each specific location, and a standard calculation which shows how the spreadsheet or program calculation applies.
4. Provide drawings showing the overall locations of the connections that are keyed/referenced to each connection calculation.
5. Calculations shall be typed, or performed by spreadsheet, or by computer program, or by other method approved by the SER. All spreadsheet calculations shall show the input and results for every calculation step and include appropriate text and sketches explaining all calculation assumptions.
6. Provide calculation checks for all forces shown on the Drawings. All AISC code requirements apply. Provide calculations for each check. "OK by inspection" is not permitted.

1.11 STRUCTURAL STEEL PRE-ERECTION CONFERENCE:

A. At least twenty (20) working days prior to the commencing of steel erection the Contractor shall hold a meeting to review the detailed requirements of the steel erection.

B. The Contractor shall prepare an agenda and require responsible representatives of every party who is concerned with the steel erection to attend the conference, including but not limited to the following:

1. General Contractor/Construction Manager
2. Steel Erector / Steel Fabricator
3. Erector's Surveyor
4. Roof Deck Contractor
5. All Testing and Inspection Agencies
6. Design Professionals
7. Owner
8. Precast or Cladding Contractor as appropriate.

C. Minutes of the meeting shall be recorded, typed and distributed by the Contractor to all parties listed above within 5 working days of the meeting.

D. The minutes shall include a detailed outline of the erection procedure including a schedule of milestone dates for surveys and sign-offs on erection stages which represents an agreement reached by all parties involved. It shall also include the surveying program and submission schedule for approval.

E. Notwithstanding any provision of the Specification, the SER shall not be responsible for and not have charge over any safety programs or precautions at the site of the Project.

1.12 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

A. See Section 01 45 00.

1.13 QUALITY CONTROL BY CONTRACTOR

A. The Contractor shall provide a program of quality control to ensure that the minimum standards specified herein are attained.

B. The Owner's general review during construction and activities of the Testing Agency are undertaken to inform the Owner of performance by the Contractor but shall in no way replace or augment the Contractor's quality control program or relieve the Contractor of total responsibility for quality control.

C. The Contractor shall immediately notify the Design Professionals of any deficiencies in the work which are departures from the Contract Documents which may occur during construction. The Contractor shall propose corrective actions and their recommendations in writing and submit them for review by the Design Professionals. After proposed corrective action is accepted by the Design Professionals and Owner, the Contractor shall correct the deficiency at no cost to the Owner. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in the OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS section of this Specification.

1.14 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

A. Observations: The Design Professionals will observe the construction for general compliance with the provisions of the Contract Documents during various phases of construction.

B. Corrections by Design Professionals: See Part 3 - CORRECTIVE MEASURES section of this Specification.

1.15 PERMITS AND WARRANTY

A. Permits: The Contractor shall apply for, procure, renew, maintain, and pay for all permits required by City, State, or other governing authorities, necessary to execute work under this Contract. Contractor shall furnish copies of all permits to the Owner and Design Professionals.

B. Warranty: Comply with General Conditions, agreeing to repair or replace specified materials or work that has failed within the warranty period.

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL

A. Structural steel shall conform to the requirements listed on the Structural General Notes.

2.2 SHOP COATINGS

A. Standard Primer: Rust inhibitive, universal phenolic alkyd metal primer 2-4mls. Color to be determined by Architect. Primer shall be compatible with, and from the same manufacturer as, top coats specified in Division 9 specification.

B. Zinc Rich Primer: SSPC-Paint 20, Type I or Type II, Zinc rich primer utilizing either an organic or inorganic binder with a minimum zinc content of 80 percent by weight in the dry film. The primer shall provide a surface meeting AISC Slip Critical Class B (slip coefficient =0.50 min) requirements. Color to be determined by Architect. Primer shall be compatible with, and from the same manufacturer as, top coats specified in Division 9 specification.

C. Hot Dip Galvanizing: ASTM A123, weight of coating shall average not less than **2.3** oz per square foot (0.70 kg/ m²), with no individual thickness less than 2.0 oz per square foot (0.61 kg/m²).

D. Galvanizing Repair Paint: ZRC Cold Galvanizing Compound, or other coating complying with SSPC-Paint 20.

2.3 ACCESSORIES

A. High Strength Bolts: Conform to the provisions of the Research Council on Structural Connections (RCSC) "Specification for Structural Joints Using High-Strength Bolts" except that nuts shall be ASTM A563 Grades DH or DH3 (hardened) for both A325 and A490 bolts. Twist off type bolts (Tension Control bolts) shall additionally conform to ASTM F1852 or ASTM F2280.

B. All bolts shall be new, and not re-used.

C. Where A325 galvanized bolts nuts and washers are required, they shall be in accordance with ASTM F2329 and ASTM A153, Class C. Where A588 steel is used, bolts, nuts and washers shall be Type 3.

D. Direct Tension Indicators: Meet requirements of ASTM F959.

E. Anchor Rods: Per structural General Notes.

F. Washers:

1. Round washers shall conform to American Standard B 27.2 type b
2. Washers in contact with high-strength bolt heads and nuts shall be hardened in accordance with ASTM Standard F436.
3. Beveled washers shall be square, smooth and sloped so that contact surfaces of the bolt head and nut are parallel.

4. The diameter of the hole of square beveled washers shall be 1/16 inch (1.5mm) greater than the bolt size for bolts smaller than one inch (25mm), and shall be 1/8 inch (3.0mm) greater than the bolt size for bolts larger than one inch (25mm).
5. Comply with requirements of RCSC for all washers including thickness, size and hardness, depending on connection details.

G. Welding Electrodes: Electrodes shall be low hydrogen type and shall have material strength matching characteristics (E70, E80, or E90) as selected from AWS D1.1, Table 3.2.

1. Shielded Metal-Arc Welding (SMAW): Welding electrodes for manual SMAW shall have a maximum H4 series level of diffusible hydrogen and conform to the Specification for Carbon Steel Electrodes; AWS A5.1, or the Specification for Low-Alloy Steel Electrodes; AWS A5.5.
2. Gas Metal-Arc Welding (GMAW): Welding electrodes for semiautomatic GMAW shall have a maximum H4 series level of diffusible hydrogen and conform to the Specification for Carbon Steel Electrodes and Rods; AWS A5.18, or the Specification for Low-Alloy Steel Electrodes and Rods; AWS A5.28
3. Flux Core-Arc Welding-Gas Shielding (FCAW-G): Welding electrodes for semiautomatic FCAW-G shall have a maximum H8 series level of diffusible hydrogen and conform to the Specification for Low-Alloy Steel Electrodes; AWS A5.29
4. Flux Core-Arc Welding-Self Shielding (FCAW-S): Welding electrodes for semiautomatic FCAW-S shall have a maximum H16 series level of diffusible hydrogen and conform to the Specification for Carbon Steel Electrodes; AWS A5.20
5. Submerged-Arc Welding (SAW): Bare electrodes and granular flux used in submerged-arc welding shall conform to F70 or F80 AWS flux classifications of the specification for Gare Mild Steel Electrodes and Fluxes for submerged-arc Welding, AWS A5.17.
6. Intermixing of welding processes shall not be permitted unless clearly indicated in Contractor's WPS submission. Contractor shall coordinate and submit for record all shop/field welding procedures, which overlap different welding process fusion zones
7. Alternate non-prequalified welding processes shall be considered based on Contractor qualifying test result submissions of Welding Procedure Specifications (WPS) and Procedure Qualification Records (PQR)

H. Headed Studs (shear connectors) shall be per Structural General Notes.

I. Deformed Bar Anchors shall be as specified in Structural General Notes.

J. Steel Castings shall conform to ASTM A27, Grade 65-35, medium strength carbon steel.

K. Grout: Refer to General Notes.

L. Post-installed Anchors shall be per Structural General Notes.

M. Slide bearing assemblies:

1. Sliding elements (upper and lower) shall be a nominal 3/32" thick glass-filled virgin polytetrafluoroethylene (PTFE). PTFE shall have:

    a) Minimum average tensile strength of 2200 psi conforming to ASTM D4894.
    b) Minimum average elongation of 200% conforming to ASTM D4894.
    c) Hardness at 78°F of 55 to 65 durometer D conforming to ASTM D2240.

2. Assembly shall have allowable bearing stress of 2000 psi (14MPa).
3. Acceptable products:

    a) Type TTX by Fabreeka
    b) Con-Slide type CSA by Con-Serve

N. Elastomeric bearing pads: Pre-formed bearing pads consisting of Neoprene or synthetic rubber molded with internal steel shims. ASTM D 2240 Shore A hardness of 60 durometer.

1. American Bearing Co., Inc. "Neoprene Bearing Pads."
2. Balco, Inc. "Neoprene Bearing Pads."
3. Fluorocarbon/Oil States Bearing Pad Division. "Elastomeric Bearing Pads."
4. Tobi Engineering, Inc. "Dura-Slide Elastomeric Pads."

PART 3 - EXECUTION

3.1 PREPARATION

A. Work by Others: Examine all work prepared by others to receive work of this Section and report any defects affecting installation to Design Professionals. Commencement of work will be construed as complete acceptance of preparatory work by others. The Contractor alone shall be responsible for checking the dimensions and coordination of the structural steel work with other trades.

B. Anchor Rods: At least 20 working days prior to the start of the structural steel erection, the Contractor shall ascertain by accurate survey the existing location, alignment, and elevation of the anchor rods embedded in the concrete by others. The Contractor shall immediately notify the Design Professionals of any discrepancies observed between the Contract Documents and the as-built conditions. Steel erection shall not start until corrective measures, if required, have been performed.

3.2 FABRICATION

A. Fabricate and assemble structural steel in the shop to the greatest extent possible.

B. Tolerances:

1. Conform to the tolerances of the AISC "Code of Standard Practice," compensate for the difference between the temperature at time of fabrication and the mean temperature in service.

2. Elevator shafts used for temporary hoists shall conform to the detailed requirements of the hoist manufacturer.

C. Holes: Holes shall be provided in members to permit connections to the work of other trades or contracts, and for passage through the member of work of other trades. All holes shall be accurately drilled, cut, or punched at right angles to the surface of the metal in accordance with AISC Specifications. Thermally cut or water jet cut holes made with CNC equipment and that meet the requirements per both AISC and RCSC specifications are permitted. Thermally cut or water jet cut holes shall meet the surface roughness requirements of ASME B46.1. Burning or drifting unfair holes will not be permitted. Holes that must be enlarged shall be reamed. Drift pins will be allowed only to bring together the several parts for connection. Holes in base plates are permitted to be drilled or thermally cut. Thermally cut holes in base plates shall meet the requirements of the AISC specification section M2.2. Holes shall be clean-cut without torn or ragged edges. Outside burrs resulting from drilling operations shall be removed with a suitable tool.

D. Camber: Provide camber as indicated on the Contract Documents. Where no camber is indicated, provide natural camber up.

E. Cutting: Manual gas-cutting in the shop may be used only if automatic or semi-automatic methods are not possible. If manual shop cutting is required, it shall be done only with a mechanically guided torch, except that an unguided torch may be used where the cut is more than 1/2 inch (12mm) from the finished dimension and final removal is completed by means such as chipping or grinding to produce a gouge-free surface of quality equal to that of the base metal. At restrained joints and as indicated elsewhere, weld access holes shall be ground smooth.

F. Cutting of Heavy Sections: Where Heavy Sections are to be joined by partial or complete joint penetration welds in tension, preheating shall be required for all thermal cutting operations. Preheat shall be sufficient to prevent cracking but in no case less than 150 degrees F (65°C). Weld access holes and copes shall be ground to a smooth radius after cutting and tested for cracks by the magnetic particle method. All cut edges shall be free of sharp notches and gouges.

G. Anchor Rods: Rigid steel templates and anchor rods shall be furnished, labeled and shipped in sets indicating sizes and locations of columns, together with instructions for setting of anchor rods. Plate washers per Typical Details shall be provided.

H. Bolting: Bolts shall be driven accurately into the holes without damaging the threads. Bolt heads shall be protected from damage during driving. Bolt heads and nuts shall rest squarely against the metal. Where bolts are to be used on beveled surfaces having slopes greater than 1 in 20 with a plane normal to the bolt axis, beveled washers shall be provided to give full bearing under the head or nut.

I. Bolts indicated as “finger tight” on the Contract Documents shall be prevented from backing off by using lock nuts, thread compound or deformed threads.

J. Installation of High Strength Bolts:

1. Except where "snug tight" installation is specifically permitted on design Drawings, all high strength bolts shall be installed with full pretension using Turn-of-Nut Pretensioning, Twist-Off Type Tension Control Bolt Pretensioning or Direct-Tension-Indicator (DTI) Pretensioning in accordance with the "Specification for Structural Joints Using ASTM A325 or A490 Bolts".
2. Comply with special washer requirements of the RCSC, such as those related to slotted and oversize holes, and tapered flanges. DTI "washers" shall not be substituted for such required washers.
3. All high strength bolt assemblies (including Tension Control bolts and DTI's) used in pretensioned connections shall be verified in accordance with the Pre-Installation Verification section of the RCSC.
4. Clean and re-lubricate bolts and nuts that become dry or rusty before use, except Tension Control bolts must be re-lubricated by manufacturer.

K. Welding of Structural Steel:

1. Pre-Weld Inspection: The surface to be welded and the filler material to be used shall be subject to inspection before welding is performed.
2. Welds indicated on the Contract Documents or the approved shop or erection drawings shall be created by electric arc welding processes that comply in all respects with the codes and specifications herein noted covering the design, fabrication, and inspection of welded structures and the qualifications of welders and supervisors. Control the heat input, weld length, weld sequence and cooling process to prevent distortion of the completed assembly.
3. Each welder's work shall be traceable.
4. Special Requirements: For High Restraint welds and welds at Heavy Sections, follow approved welding procedures for weld process, sequence, pre-heating and cooling. Use stress relieving techniques where shown in the approved procedure developed by the Contractor's Welding Consultant.

    a) Special Procedures: Prior to the start of production welding, the contractor shall demonstrate to the Testing Agency that preheat can be maintained without relying on heat from the arc. For field welding, the contractor shall provide a shelter to protect each joint from inclement weather (rain, snow, etc.), from start until completion of the joint.
    b) Preheat and Postheat: Preheat shall be sufficient to prevent cracking, but in no case less than required by AWS D1.1. The Contractor shall prepare a written welding sequence and distortion control plan to be included in the welding procedures submittal. Assembly sequence of adjoining parts shall balance applied induced heat from preheat and welding processes to minimize distortion and shrinkage. Assemblies shall include special considerations to minimize significant shrinkage stress restraint in accordance with AWS D1.1, Annex H provisions. Under conditions of severe external shrinkage restraint, preheat temperature limitations for making welds shall be in accordance with AWS D1.1, Annex H, Table H2. Under conditions of severe external restraint, reduction of induced heat and cooling rate shall be monitored under the provisions of the Hydrogen Control/HAZ Hardness Control methods of AWS D1.1, Annex H. The preheat shall be maintained

throughout the thickness of the material for a distance equal to twice the material thickness on both sides of the joint at a minimum. Where different thicknesses of steel are being joined, the greater thickness shall govern. Preheat shall be measured on the face opposite the side of the heat application. Preheat shall be applied uniformly in a manner that does not harm the surface of the material nor cause surface temperatures to exceed 1100 degrees F (600ºC). Should stress relief heat treatment be required, the contractor shall submit a written procedure.

c) Prior to heat treatment on a production weld, prepare and treat a test sample per the Contractor's written procedure for tests in accordance with ASTM requirements.

5. Welded Joint Details:

a) Welding Backing: The use of weld backing shall be in accordance with AWS D1.1. Weld backing shall be removed where required by the Contract Documents or for the WPS by AWS D1.1.

b) Weld Tabs:

i. Use of Weld Tabs: Welds shall be terminated at the end of a joint in a manner that will ensure sound welds in accordance with AWS D1.1. Whenever necessary, this shall be done by use of weld tabs.

ii. Heavy Section Joint Weld Tab Removal and Finish: All welded tension splices in Heavy Sections shall have the weld tabs removed and ground smooth.

c) Weld Access Holes:

i. Weld access holes shall meet the dimensional, surface finish, and testing requirements of AISC 360 Chapter J1.6 and AWS D1.1, except as otherwise required by the Contract Documents.

d) Welding for moment connections shall be sequenced so as to minimize residual stress in the joint.

6. Deficient Welds: Welds found deficient in dimensions but not in quality may be enlarged by additional welding. Any weld found deficient in quality shall be removed by grinding or melting and the weld shall be remade.

L. Bearing:

1. Bearing ends of columns shall be milled or sawn square perpendicular to axis of the column, or at slope indicated in the Contract Documents.
2. Finish bearing areas of base plates per AISC M2.8.

M. Stiffeners: Fitted stiffeners shall be ground to fit closely against flanges.

N. Cleaning and Preparation of Steel Surfaces:

1. Clean all steel work in accordance with the Society for Protective Coatings (SSPC) Method specified herein that corresponds to its location and exposure. Steel work to be painted shall be painted within the same day that it is cleaned.

    a) Interior, Not Exposed to View (above suspended ceilings, under sprayed-on fireproofing, steel to be encased in concrete): SSPC-SP-2, Hand Tool Cleaning.
    b) Interior, Exposed in the Finished Building: SSPC-SP-6, Commercial Blast Cleaning, unless noted otherwise on the Drawings.
    c) Exterior (exposed to weather or in unconditioned space): SSPC-SP-6, Commercial Blast Cleaning, unless noted otherwise on the Drawings.
    d) Members to be Hot Dipped Galvanized: SSPC-SP3, Power Tool Cleaning, before galvanizing.

O. Shop Coating:

1. Where painting is specified, paint all steel work in accordance with the Society for Protective Coatings (SSPC) Method specified herein that corresponds to its location and exposure and in accordance with manufacturer's written instructions. Paint steel work the same day that it is cleaned.

    a) Interior, Not Exposed to View (above suspended ceilings, under sprayed-on fireproofing, steel to be encased in concrete): No Paint.
    b) Interior, Exposed in the Finished Building: SSPC – Paint 25
    c) Exterior (exposed to weather or in unconditioned space): SSPC – Paint 20

2. Protect finished bearing surfaces with a rust-inhibiting coating which is to be removed immediately prior to erection.
3. Do not paint:

    a) Surfaces within six (6) inches (150mm) of field welds
    b) Surfaces to be encased in concrete or to receive cementitious fireproofing
    c) Contact surfaces of high-strength bolted Slip Critical connections (unless surface prep and paint has been specifically prequalified by the contractor or approved for use in this location by the SER)
    d) Surfaces required for testing and preheat, until all testing and preheat has been performed
    e) Finished bearing surfaces (use removable rust-inhibiting coating)
    f) Top flange of the beam where steel deck or headed studs are to be attached

4. Paint shall be applied thoroughly and evenly to dry surfaces only when surface temperatures are above dew-point, in strict accordance with manufacturer's instructions.
5. Surfaces of exterior members which are inaccessible after assembly or erection shall receive their second coat of the approved paint, in a different shade, in the shop.
6. Hot-dip galvanize the following steel members:

a) All angles, steel plates and shims supporting exterior masonry or exposed to the weather, including shelf, arch and relieving angles
b) All connections between the above angles and steel plates and the supporting structural member, including clip angles and hardware
c) Any other steel members indicated as “Galvanized” on the Contract Documents.
d) All miscellaneous metal, angles, clips, etc. on exterior masonry walls.

3.3 ERECTION

A. Tolerances: Erect all work plumb, square and true to lines and levels in strict accordance with the structural requirements of the building within tolerances of the AISC Code of Standard Practice, unless otherwise indicated on the Contract Documents. Compensate for the difference between the temperature at time of erection and the mean temperature in service.

B. Bracing: Brace the frame during erection in accordance with the Contractor’s erection procedure.

C. Errors: Immediately notify the Design Professionals of any errors in shop fabrication, deformations resulting from handling and transportation, and improper erection that affects the assembly and fitting of parts. Prepare details for corrective work and obtain approval of the method of correction. Approved corrections shall be made expeditiously at the sole expense of the Contractor.

D. Column Base Plates: Support and align on steel shims or setting bolts. After the supported members have been plumbed and properly positioned, tighten anchor rod nuts in preparation for grouting. Cut off wedges and shims flush with edges of plates and leave in place. The use of leveling plates will not be permitted without prior written approval by the SER. Contractor proposing the use of levelling plates shall provide documentation of plumbing procedure and remediation procedure for gaps between leveling plate and column base plate for SER review.

E. Grouting: Refer to General Notes. Grout base plates immediately after the first tier of columns are plumbed. Do not proceed with steel erection above the first tier until base plates are grouted.

F. Bolting and Welding of Structural Steel: See Section on "Fabrication".

G. Bearing Surface: Clean bearing surfaces and surfaces that will be in permanent contact before the members are assembled.

H. Splices: Splices will be permitted only where indicated on the Contract Drawings or the reviewed shop drawings. Fasten splices of compression members only after surfaces are cleaned and abutting surfaces have been brought completely into contact. Fill any remaining gaps with steel shims driven into place and cut flush. Tack weld shims to each other and to members. Use runoff tabs at bevel weld splices. Cut off runoff tabs and ground smooth after weld completion.

I. Driftpins: Driftpins may be used only to bring together the several parts, and shall not be used in such a manner as to distort or damage the metal. Correct poor matching of holes by drilling to the next larger size and using a larger size bolt. Plug welding and redrilling will not be permitted, unless a specific instance arises and is approved by the SER.

J. Erection bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces. On non-exposed welded construction, remove erection bolts.

K. Hammering: Hammering which may damage or distort the members will not be permitted.

L. Do not use cutting torches in the field without the specific approval of the SER for each application. Where cutting torch use is permitted, all the requirements of the Section on "Fabrication" shall apply.

M. Additional Material and Labor: If the Contractor furnishes additional material and labor for the purpose of erection or if the erection method requires that material be added to certain members, the required modifications shall be at the sole expense of the Contractor.

N. Alignment: Following erection, accurately align, level, and adjust all members prior to final fastening. Conform to AISC standard tolerances unless otherwise noted in the Contract Documents.

O. Touch-Up and Field Applied Paint: After erection, clean all damaged areas in the shop coat, exposed surfaces of bolts, bolt heads, nuts and washers and all field welds and unpainted areas adjacent to field welds according to manufacturers recommendations and paint with the same paint used for the shop coat. Match the touch up and field applied paint color to the as-built paint color. After touch up, at exterior (exposed to the weather or in unconditioned space) steel members apply a full coat of the specified paint in a different shade than the shop applied coat.

P. After erection, clean all damaged galvanized areas, welds and areas adjacent to welds and paint with the specified galvanizing repair paint.

Q. Clean all steel members of mud and debris and construction residue prior to erection.

R. Headed Studs and Deformed Bar Anchors:

1. End weld headed studs and deformed bar anchors with an automatic process in accordance with section 7 of AWS D1.1.
2. Areas to which studs are to be attached must be free of foreign material, such as rust, oil, grease, paint etc. When mill scale is sufficiently thick to cause difficulty in obtaining proper welds, remove by grinding or sand blasting.
3. Remove ceramic ferrules from studs and work after welding.
4. Replace any studs that crack or break. Only straighten studs that would foul other work or have less than 1 inch (25mm) cover in bent position.

3.4 CORRECTIVE MEASURES

A. Conflicts: The Contractor shall be solely responsible for errors of detailing, fabrication, and erection of structural steel, steel joists, and steel deck.

B. Compensation for Additional Services: Should additional work by Design Professionals such as design, documentation, meetings and/or site visits be required which are necessitated by failure of the Contractor to perform the work in accordance with the Contract Documents either developing corrective actions or reviewing corrective actions developed by others, the Contractor is responsible for paying for additional work performed by the Design Professionals at their standard firm-wide billing rates plus out-of-pocket expenses incurred at cost + 10%. Additional costs for testing and inspection by the Owner shall also be compensated by the Contractor.

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Structural Substitution Request Form – to be completed by Contractor

Project:		Substitution Request #
Date:		
Requesting Contractor:		Pages Attached (including this form)

1. Description of Requested Substitution:

2. Related Drawings and Specification Sections:

3. Rationale or Benefit Anticipated:

4. Effect on Construction Schedule[1] (check one): ☐ NONE ☐ See Attached

5. Effect on Owner's Cost[2] attach data (check one): ☐ CREDIT TO OWNER ☐ EXTRA

6. Effect on Construction Documents[3] (design work anticipated): ☐ NONE ☐ See Attached

7. Requesting Contractor Agrees to Pay for Design Changes (check): ☐ YES ☐ NO ☐ NOT APPLICABLE

8. Effect on Other Trades[4]:

9. Effect of Substitution on Manufacturer's Warranty (check): ☐ NONE ☐ See Attachment

Signature[5]: Date:

Company:

General Contractor Signature[5]: Date:

Notes:

1. Contractor is responsible for means and methods and any problems that may arise from making the requested substitution.
2. This is **NOT A CHANGE ORDER FORM**. A separate form is required to adjust costs and/or schedules.
3. Contractor is responsible for any design impacts that may arise from this substitution, including redesign efforts.
4. Contractor is responsible for effects on other trades from this substitution;
   General Contractor must review and agree effects on other trades are fairly represented in items 4-9.
5. Signature by a person having authority to legally bind his/her company to the above terms. Otherwise this request is void
6. All items in form must be completed for substitution request to be considered.

Request Review Responses (completed by Architect and/or Engineer(s)):

ACCEPTED	ACCEPTED AS NOTED	REJECTED	INSUFFICIENT DATA TO SUPPORT REQUEST	ENGINEER / ARCH / MEP SIGNATURE	DATE

Engineer/Architect Comments:

END OF SECTION

SECTION 05 20 00 - STEEL JOISTS

PART 1 - GENERAL

1.1 GENERAL

Related Documents: Drawings and General Provisions of the Contracts, including the Division 1 Specification Section, apply to this section.

1.2 SCOPE

The work under this section includes design, fabrication and erection of open web steel joists and joist girders as indicated on the Drawings, complete with bridging, attached seats and anchors, joist substitutes compatible with joist seat depths at short spans, labor, accessories and services necessary for the installation of joists and related work.

The work shall include supplementary parts and members necessary to complete joist and joist girder work, regardless of whether such parts and members are indicated on the Drawings.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Quality Assurance: Structural Testing and Inspection	Section 01 45 00
Cast-In-Place Concrete	Section 03 30 00
Concrete Unit Masonry	Division 4
Structural Steel	Section 05 12 00
Steel Deck	Section 05 30 00
Cold-Formed Metal Framing	Section 05 40 00
Miscellaneous Metals	Division 5
Fireproofing	Division 7
Painting	Division 9

1.4 CODES AND STANDARDS

A. Building Code: Work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards: See Section 05 12 00 and the following:

1. Steel Joist Institute (SJI) - Standard Specifications for Open Web Steel Joists, SJI-K.
2. SJI - Standard Specifications for Longspan Steel Joists, LH-series and Deep Longspan Steel Joists, DLH-series, SJI-LH/DLH.
3. SJI – Standard Specifications for Joist Girders, SJI-JG.
4. SJI – Code of Standard Practice for Steel Joists and Joists Girders.

C. Definitions:

1. See Section 05 12 00.

1.5 CONTRACTOR QUALIFICATIONS

A. See Section 05 12 00.

B. Steel Joist manufacturer: Shall be a member of the Steel Joist Institute.

1.6 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested.

(1) Submittal Schedule
(2) Shop Drawings and Erection Drawings
(3) Submittal Letter
(4) Certificate of Compliance

1. Submittal Schedule: See Section 05 12 00
2. Shop Drawings and Erection Drawings: Submit for action

a) Design calculations showing loads and other design criteria used for design of the joists and joist girders, bridging details for conditions not addressed by SJI standard bridging details, and connection details for field splices, for joist headers and for connections not addressed by SJI standard connection details. Calculations shall include a cover letter sealed and signed by a Professional Engineer licensed in the state where the project is located for joists to meet the design load requirements indicated on the plans.

b) A complete set of Shop Drawings using standard designations and showing sizes, configurations, profiles, coding, camber, provision for, bridging, connections and attachments, surface preparation and finishes including primer product description and manufacturer. Show design loads and calculation references.

c) A complete set of Erection (Joist Placement) Drawings using standard designations, showing joist, joist girder and joist header design loads, sizes, cambers, spacing, locations, connections and supports; coding; bridging sizes, locations, connections and attachments; field splices: and surface preparation and finishes, including primer product description and manufacturer. For all non-SJI standard joists, also show custom configurations, profiles and deflection criteria for live and total loads.

3. Submittal Letter: Joist manufacturer shall submit for record a letter accompanying the design calculations signed by their Engineer stating that they have received all structural steel Specification sections and have prepared their work in accordance with these Specifications.

4. Certificate of Compliance: Upon completion of fabrication, the steel joist manufacturer shall submit for record a signed certificate of compliance stating that the work was performed in accordance with approved construction documents and with SJI Standard Specifications and that all material meets the specified requirements.

B. Submittal Process: See Section 05 12 00.

C. Submittal Review: See Section 05 12 00.

D. Substitution Request: See Section 05 12 00.

E. Request for Information (RFI): See Section 05 12 00.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect steel joists and accessories in transit, in storage, while handling and during erection.

B. When stored at site, store steel joists above ground on platforms, pallets, skids, trailers, or other supports and provide weatherproof covering to maintain clean and dry. Keep joists free of dirt and other foreign matter.

C. Support steel joists in such a manner as to prevent distortion of members and injury to shop paint.

1.8 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

A. See Section 01 45 00.

1.9 QUALITY CONTROL BY CONTRACTOR

A. See Section 05 12 00.

B. Manufacturer shall maintain a quality control manual containing manufacturing tolerances (sweep, camber, depth, length, components locations, standard welding requirement, other fabrication requirements, etc.). Quality control manual shall be made available to the Owner's Testing Agency for review and use.

C. Manufacturer shall inspect joists to extent he deems necessary to assure fabrication is in accordance with Drawings, Specifications and manufacturer's design calculations, including the following:

1. Visually inspect welds to assure that size, length, and location of welds are in accordance with submitted shop drawings and details of welded connections.

2. Observe joint preparation assembly practices, welding techniques and performance of welding to assure that welding work is being performed in accordance with written welding procedures.
3. Test weld performance at random intervals. Pull test welds at light joists; if any fail, reinforce all welds made in that lot. Bend test welds at larger chords, at least

5% of welds and at every size change; if any fail, reinforce or repair all welds in that lot.

4. Check joists for over-all length, depth, camber, sweep, components size, locations and materials etc. to assure dimensions conform to tolerances specified herein and manufacturer's quality control manual.
5. Visually inspect painting of joists to assure appearance is in accordance with Contract Documents.
6. Randomly test paint thickness of joists to assure paint meets dry film thickness requirements.

D. Issue reports of inspections to Owner's Testing Agency prior to shipping joists.

1.10 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

A. See Section 05 12 00.

1.11 PERMITS AND WARRANTY

A. See Section 05 12 00.

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL JOISTS:

A. Acceptable Manufacturers:

1. Vulcraft Div., Nucor Corp.
2. The New Columbia Joist Company, SMI.
3. Canam United States, Canam Group
4. New Millennium Building Systems

B. All joists shall be designed:

1. In accordance with the SJI Standard Specifications except as noted herein.
2. In the configurations shown on the Contract Documents.
3. To resist the loads and forces listed on the Contract Documents.
4. To meet deflection limits as listed on the Contract Documents using effective moment of inertia.
5. To consist of rolled shapes (or bent angle chords up to ¼ inch thick), not bent plate 'hat sections.'
6. With all joist components meeting the requirements of the SJI Standard Specifications, except as defined in this Specification.
7.

C. Materials and Types:

1. All material shall be structural steel meeting the requirements of the joist design. Mill Test Reports shall be available for and traceable to all materials used.
2. Open Web Joist Members: SJI standard types, as indicated on the Drawings.
3. Joist Girders

D. Standard Primer: Unless specifically defined otherwise, Use manufacturers Standard Primer in dipped application conforming to SSPC-Paint 15, or manufacturer's standard shop primer meeting the performance requirements of this primer.

E. Surface preparation – SSPC-SP2 or SSPC-SP3 minimum, unless higher surface preparation standard is required by coating manufacturer's minimum recommendation.

F. Fabrication:

1. Design and fabricate steel joists including headers and other supplementary framing; follow SJI Standard Specifications, except as noted in this Specification.
2. Fabricate joist with SJI standard camber, except where the design Drawings call for specific camber or for un-cambered geometry. At joists adjacent to rigid framing, design with greater stiffness and reduced camber indicated on Drawings for deck transition.
3. Provide bottom and top joist chord extensions as required.
4. Provide sloping shoes or beveled ends where required to provide full bearing of sloping joists or on sloping bearing surfaces.
5. To support point loads where shown on the Contract Documents, if a custom web pattern is specified, lay out joist panel points to occur at locations coinciding with the point loads.
6. To support point loads where shown on the Contract Documents, if a standard web pattern is permitted, provide web stiffeners/struts to deliver point loads to panel points.
7. Prepare and shop prime joists. Do not prime surfaces to be field welded or in contact with concrete or cementitious fireproofing materials.
8. See Drawings for additional bridging requirements that may affect bridging locations and/or configurations.

PART 3 - EXECUTION

3.1 ERECTION

A. Joist Installation:

1. Coordinate placement of anchors in concrete and masonry construction for securing bearing plates. Coordinate attachment holes in structural steel members.
2. Do not install joists until supporting work is in place and secured. When supporting structure is a grouted masonry wall, or cast-in-place concrete, the supporting material shall attain at least 75% of the specified compressive strength prior to joist installation.
3. Erect steel joists following SJI Standard Specifications
4. Bear joists on supports following SJI Standard Specifications
5. Space joists as indicated on Contract Documents
6. Laterally brace joists adequately during erection following SJI recommendations
7. After placing steel joists on supporting work, but before permanently fastening, adjust and align in accurate location and spacing, shimming as required to keep top chords at proper elevation,

8. Where the design requires bottom chord extensions to be connected, do not attach joist bottom chord extensions until all dead load is in place.
9. Permanently fasten joists to supporting work, install permanent bridging and inspect erected framework before any construction or dead loads are applied.
10. During erection period, provide means for adequate distribution of concentrated loads so that load carrying capacity of any joist is not exceeded
11. Do not field cut or alter joists without engineering direction of the joist manufacturer, and written approval of Design Professional.

B. Bridging Installation:

1. As a minimum, provide horizontal and/or diagonal type bridging for joists, complying with SJI Standard Specifications, including bridging designed and located to satisfy uplift loads indicated on the Drawings.
2. Install bridging immediately after erection and before construction loads are applied.
3. Bridging shall support top and bottom chords against lateral movement during construction period and hold joists in locations indicated on Drawings.
4. Connect bridging to joists by welding or mechanical means, with connections capable of resisting a minimum horizontal force in accordance with SJI. Do not tack weld bridging to joists or supports. Use fillet welds with a length of four (4) times weld throat thickness, or use length of weld divided by four (4) to determine usable throat thickness.
5. Bolt rigid x-bracing at intersection of two angles between joists.
6. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams as indicated on Drawings and in SJI Standard Specifications.

3.2 FIELD TOUCH-UP PAINTING

A. After erection, inspection and acceptance of erected joists, touch up damaged shop paint, repaired welds, rust spots and field connections.

B. Field touch-up paint shall be the same as that used in shop painting of joists.

3.3 CORRECTIVE MEASURES

A. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in Part 3 – CORRECTIVE MEASURES section of Specification 05 12 00.

END OF SECTION

SECTION 05 30 00 - STEEL DECK

PART 1 - GENERAL

1.1 GENERAL

Work of this Section shall conform to the requirements of Drawings and general provisions of the Contract, including General Conditions, Supplementary General Conditions and Division 1 Specification sections.

1.2 SCOPE

The work covered by this Section shall include all labor, material, equipment, permits, engineering and other services necessary for the design and installation of composite and non-composite structural steel floor deck systems, steel roof deck systems and related work with all attachments, flashings, metal closures, concrete stops, accessories and fittings as required for a complete installation in accordance with the Drawings and as specified herein.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Quality Assurance: Structural Testing and Inspection	Section 01 45 00
Concrete	Section 03 30 00
Structural Steel	Section 05 12 00
Steel Joists	Section 05 20 00
Cold-Formed Metal Framing	Section 05 40 00
Miscellaneous Metals	Division 5
Fireproofing	Division 7
Painting	Division 9

1.4 CODES AND STANDARDS

A. Building Code: Steel deck work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards:

1. All steel floor and roof deck manufacturers shall be listed in the Underwriter's Laboratories "Fire Resistance Index of Companies".
2. American Iron and Steel Institute (AISI) “Specification for the Design of Cold-Formed Steel Structural Members”.
3. American Welding Society AWS D1.3 , “Structural Welding Code – Sheet Steel.”
4. American Society for Testing and Materials "ASTM Standards in Building Codes", various standards as referenced herein.
5. Steel Deck Institute (SDI) “Design Manual for Composite Decks, Form Decks and Roof Decks”.

C. Definitions:

1. See Section 05 12 00.

1.5 STEEL DECK MANUFACTURER AND CONTRACTOR QUALIFICATIONS

A. The Manufacturer and the Steel Deck Erector ("Erector") shall each demonstrate a minimum of ten (10) years of experience with the specified steel deck systems.

B. The Erector shall use prequalified welding processes in accordance with the AWS Structural Welding Code and shall provide certification that those welders to be employed in the Work are currently qualified for those processes and have satisfactorily passed the applicable AWS qualification tests.

C. Contractor's Engineer shall be qualified to perform the type of work required by the project. The Engineer shall be a Professional Engineer licensed in the state where the project is located. The Contractor's Engineer shall have 10 years of experience in responsible charge of work of this nature, on steel deck installations similar to this Project in material, design, and extent, with a record of successful in-service performance. Proposed Contractor's Engineer shall be subject to approval of Design Professionals and Owner.

1.6 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested.

(1) Submittal Schedule
(2) Calculations, Shop Drawings and Erection Drawings
(3) Manufacturer's Certification
(4) Manufacturer's Installation Instructions
(5) Welder Certifications
(6) Research Reports or Evaluation Reports

1. Submittal Schedule: The Steel Deck Contractor shall submit for action a schedule of drawing and calculation submissions at least twenty (20) working days prior to commencing submission of drawings and calculations. The schedule will indicate the number of drawings and calculations proposed to be submitted each week. Any modifications to the schedule shall be submitted for approval at least twenty (20) working days prior to modification is proposed to take place.
2. Calculations, Shop Drawings and Erection Drawings (including Field Work Drawings): Submit for record manufacturers standard load tables and calculations for items designed by the Contractor's Engineer including substitution requests. Submit for approval shop drawings and erection drawings for all steel deck indicated on the Contract Documents.

a) Materials shall not be fabricated or delivered to the site before the shop drawings have been approved or approved as noted by the Design Professionals and returned to the Contractor.

b) Submit for record, prior to or with shop drawings, calculations for items designed by the Contractor's Engineer. Calculations shall address all design gravity, uplift, and in-plane diaphragm loads indicated. Each calculation package shall be sealed and signed by the Contractor's Engineer.

c) Shop Drawings shall clearly indicate:

i. Deck types (profiles), steel gauges, and deck finishes.
ii. Deck layout, including panel locations, number of deck spans per panel, structural support locations and joint locations.
iii. Deck dimensions and sections keyed to layout plans, including side and end details and bearing requirements.
iv. Deck fastener types (welds, screws, pins, proprietary systems) and layout patterns at panel sides, ends and interior supports.
v. Deck manufacturer, profiles, properties, vertical load capacity and in-plane diaphragm shear capacity for all as-detailed conditions.
vi. Details and locations of accessories including hardware, framing reinforcement anchorage, sump pans, cant strips, ridge plates, valley plates and closure plates.
vii. Fabrication necessary to incorporate steel deck into the job.
viii. Correlation with other requirements, openings and flashings.
ix. Fully dimensioned layout of field-installed headed studs (shear connectors).
x. Contractor-coordinated openings for mechanical, electrical, plumbing, fire protection and other trades.

d) A letter shall be submitted along with the shop drawings. It shall bear the registration number seal, signature and address of the Professional Engineer who prepared or supervised the calculation and reviewed the shop drawing submittal and shall include the following: "The steel deck calculations have been developed for this project and are designed by me, or by qualified personnel under my direct supervision, to resist the loads and reactions indicated on the Contract Documents. I have reviewed the steel deck layout drawings and they comply with assumptions used to develop the steel deck calculations."

e) The Contractor shall have reviewed and approved the shop drawings prior to submission to the Design Professionals for their review, representing that the Contractor has verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog number and similar data with respect thereto and reviewed or coordinated each drawing and sample with the work of other trades and with the requirements of the project and the Contract Documents.

3. Manufacturer's Certification: Submit for record a letter of certification from the deck manufacturer stating that the design, the detailing and fabrication of the

steel deck to be installed under this Section are in accordance with the SDI Design Manual for Composite Decks, Form Decks and Roof Decks.

4. Manufacturer's Installation Instructions: Submit for record Manufacturer's literature providing recommended installation instructions.
5. Welder Certifications: Submit for record welder certificates signed by the Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
6. Research or Evaluation Reports: Submit for record research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence steel deck's compliance with the building code in effect for the Project.

B. Submittal Process: See Section 05 12 00.

C. SER Submittal Review: See Section 05 12 00.

D. Substitution Request: See Section 05 12 00.

E. Request for Information (RFI): See Section 05 12 00.

1.7 COORDINATION AND TEMPORARY SUPPORT

A. Consult and cooperate with Contractors for other trades whose work affects or is affected by work under this Section in order that all phases of the work are properly coordinated to avoid delays, errors, omissions, or damage to any part of the work.

B. Steel Deck Contractor shall inform General Contractor of any special support requirements such as shoring of deck for wet concrete loads.

C. General Contractor shall coordinate with Steel Deck Contractor regarding any construction loads on deck before concreting, and on completed deck in excess of the design loads shown. Such conditions may include both gravity and lateral loads.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not bend or mar decking.

B. Store off ground with one end elevated for drainage.

C. Cover decking with waterproof material, ventilated to avoid condensation.

D. Do not store deck bundles on framing unless material is securely tied down and the framing has been analyzed to ensure that such storage will not cause an overload.

1.9 STRUCTURAL STEEL PRE-ERECTION CONFERENCE

A. See Section 05 12 00.

1.10 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

A. See Section 01 45 00.

1.11 QUALITY CONTROL BY CONTRACTOR

A. See Section 05 12 00.

1.12 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

A. See Section 05 12 00.

1.13 PERMITS AND WARRANTY

A. See Section 05 12 00.

PART 2 - PRODUCTS

2.1 GENERAL

The work specified herein is based on the products of Vulcraft In order to establish design quality and function in the installed work. Products of other manufacturers shall be subject to the approval of the Design Professionals. All steel deck units shall be of the same depth and profile as shown on the Drawings and the product of one manufacturer.

2.2 DESIGN

A. Section properties of the steel deck units shall be calculated in accordance with the AISI "Specification for the Design of Cold-Formed Steel Structural Members". The minimum positive and negative section moduli so obtained shall be used in calculations involving positive and negative moments, respectively, in determining the required gauges of steel deck units.

B. Where indicated on Drawings or Structural General Notes, the Contractor's Engineer shall design the steel deck using the load criteria shown on the Drawings and the design criteria specified herein.

C. The Contractor's Engineer shall be responsible for determining the suitability of single, double and multiple span lengths of decking for analysis under service and construction conditions.

D. Design of steel deck not receiving concrete fill:

1. Resist design loads using bare steel deck properties. Consider both construction loads and specified loads.
2. Use three span continuous layouts wherever possible.

E. Design of steel deck to receive concrete fill:

1. Design to work compositely with the concrete fill, unless otherwise specifically noted in the Contract Documents as 'form deck.'
2. Assume deck acts with hardened concrete in a simple-span mode unless otherwise specifically noted on the Contract Documents.

3. Resist superimposed dead and live loads indicated on Drawings, but not less than 150 psf (7.5kPa) superimposed load on composite slab.
4. Resist construction loads using bare steel deck properties.
5. Assume unshored construction unless shoring is specifically coordinated with the General Contractor prior to design.
6. Use three span continuous layouts wherever possible.

F. At spans where trenches cross steel deck, design the interrupted deck ends as noncomposite cantilevers capable of supporting a superimposed dead and live load of 150 psf (7.5kPa) excluding concrete fill, unless greater load capacity is required by the Contract Documents. Increased deck gauge may be necessary to satisfy this loading condition.

2.3 MATERIALS

A. Composite Steel Floor Deck

1. Galvanized Steel Deck: shall be formed from steel sheets conforming to ASTM A653, Structural Quality Grade 33 (minimum) with minimum yield strength of 33 ksi (230MPa). Before forming, the steel sheet shall be zinc coated conforming to ASTM A924, G60.
2. Phosphatized/Painted Steel Deck: shall be formed from steel sheets conforming to ASTM A1008 SS Grade 33 (minimum) with minimum yield strength of 33ksi (230MPa). Prior to painting, the steel shall be chemically cleaned and pre-treated. Following pre-treatment, the bottom side of deck shall be painted with high-heat, baked-on thermal setting primer.

B. Steel Roof Deck, Form Deck: shall be formed from steel sheets conforming to ASTM A653, Structural Quality Grade 33 (minimum) with minimum yield strength of 33 ksi (230MPa). Before forming, the steel sheet shall be zinc coated conforming to ASTM A924-G60.

C. Floor decking shall be formed with integral locking lugs or embossments to provide a mechanical lock between the steel floor and the concrete slab sufficient to resist at least twice the design shear force. Minimum depth of embossments or locking lugs shall be .050"(1.3mm).

D. All steel decking shall be roll formed for uniformity in dimension and strength.

E. Floor and roof decking shall be classified by Underwriters' Laboratories, Inc. Each unit or bundle shall be labeled and marked as required by UL, indicating manufacturer, testing, and inspection.

2.4 ACCESSORIES

A. General: Provide accessory materials for steel deck that comply with requirements indicated and recommendations of the steel deck manufacturer.

B. Side Lap Fasteners: Manufacturer's standard, corrosion-resistant, hexagonal washer head; self-drilling, carbon steel screws, No. 10 minimum diameter.

C. Pour Stops and Girder Fillers: Steel sheet, of same material as deck panels, and of thickness and profile indicated, but not less than the deck gauge.

D. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material and thickness as deck panels, unless otherwise indicated.

E. Hanger Tabs: Manufacturer's standard UL rated piercing steel sheet hanger attachment devices for floor deck panels.

F. Recessed Sump Pans: Manufacturer's standard size, single piece steel sheet 0.071-inch (1.8mm) thick minimum, of same material as deck panels, with 1-1/2-inch (40mm) minimum deep level recessed pans and 3-inch (75mm) wide flanges. Cut holes for drains in the field.

G. Flat Receiver Pan: Manufacturer's standard size, single-piece steel sheet, 0.071" (1.8mm) thick minimum units, of same material as deck panels.

H. Miscellaneous Roof Deck Accessories: Steel sheet ridge and valley plates, finish strips, and reinforcing channels, of same material and thickness as roof deck unless otherwise indicated.

I. Headed Studs (shear connectors) shall be per Structural General Notes.

J. Steel Sheet Accessories: ASTM A 653, galvanized to G60 coating class conforming to ASTM A924.

K. Galvanizing Repair Paint: SSPC Paint 20 or MIL-P-21035, with dry film containing a minimum of 94% zinc dust by weight.

L. Flexible Rib Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.

M. Sound-Absorbing Insulation: As required by the Contract Documents, provide manufacturer's standard premolded roll or strip glass fiber or mineral fiber.

2.5 SIDE JOINT HANGER SYSTEM FOR USE IN COMPOSITE STEEL FLOOR DECK ONLY

A. Provide hanger tabs along the side joints of units at 1'-0" (300mm) centers.

B. Side joint hanger tabs shall have a minimum allowable static load capacity of at least 100 lbs (45kg) and shall accommodate a flat bar hanger (no rod hangers).

C. All hangers, their installation, and tab activation shall be by trades requiring the tabs.

D. No plastered ceilings shall be hung from side joint hanger tabs.

E. No mechanical, electrical, plumbing or fire protection loads shall be hung from deck side joint hanger tabs.

2.6 MISCELLANEOUS MATERIALS

A. Arc-Welding Electrodes: AWS A5.1 E60XX or E70XX Series, as required for the conditions of use.

B. Touch Up Paint: use galvanized repair paint specified above.

C. Closure Tape as required to maintain cells clear of concrete at abutting panel ends.

PART 3 - EXECUTION

3.1 PREPARATION

A. Work by Others: Examine all work prepared by others to receive work of this Section, especially plan and elevation locations of supporting frames and walls. Report any defects affecting installation to Design Professionals. The Contractor alone shall be responsible for checking the dimensions and coordination of the steel deck work with other trades.

B. Do not place deck units on supports with debris or unapproved coatings that could affect full, level bearing and proper connections.

C. Do not place deck units on concrete supporting structures until concrete has cured and is dry.

D. Coordinate the location of decking bundles with a structural steel erector to prevent overloading of structural members.

3.2 ERECTION – PLACEMENT

A. Erect steel deck in accordance with the decking manufacturer's recommendations and the requirements of the Drawings and these Specifications.

B. Place steel deck on the supporting framework and adjust to final position with ends accurately aligned and bearing on supporting members before making permanent connections. Do not stretch or contract sidelap interlocks.

C. Place deck units flat, square, without warping or excessive deflections, in straight alignment for entire length of run of cells and with close alignment between the cells at ends of abutting units.

D. Abutting ends of deck panels shall occur over supports. End bearing shall be a minimum of 2 inches (50mm), or greater if required (web crippling) by deck manufacturer.

E. Where deck panels nest, laps shall be a minimum of 2" (50mm) and shall occur over supports. Nesting is permitted only where profiles are designed to nest and are fabricated with offset ends.

F. Install slab edge closures and pour stops at the theoretical position with maximum tolerance of + 3/8" (10mm). Closures and pour stops shall have adequate adjustments to maintain this tolerance while accommodating the structural steel frame tolerances.

3.3 ERECTION - CONNECTIONS

A. Connect steel deck to the steel framework at ends of units and at intermediate supports as shown on the Contract Documents and approved shop drawings.

B. Deck to support welds shall be puddle welds of diameter and spacing shown on Contract Documents and/or approved shop drawings.

C. Use welding washers for puddle welding at deck thinner than 22 gauge (0.85mm) and where recommended by the manufacturer

D. Where headed studs occur, if fused to deck for full weld perimeter each headed stud may be considered to replace one puddle weld

E. Fasten side laps and perimeter edges of panels between supports by button punching, side seam welding or screws, or as noted on Construction Drawings.

3.4 ERECTION – OPENINGS AND CLOSURES

A. Contractor to coordinate location of all openings with other trades (see Submittals).

B. Cut and install sleeves and holes through decking for openings indicated on the Architectural, Structural, and/or Mechanical-Electrical-Plumbing-Fire Protection Drawings. Cost shall be paid by the trade requiring such sleeves and holes. Sleeves will be furnished by the various trades requiring them. Provide and install reinforcement as required around sleeves. Where possible, leave deck intact and use block outs to hold back concrete at openings. Cut deck after concrete cures.

C. Provide miscellaneous headers and other steel reinforcing and supports welded to decking and structural steel as required at penetrations, around columns, etc. per typical details and manufacturer's recommendations.

D. Field cutting parallel to flutes shall be done in the low flutes, taking care to leave sufficient horizontal material to permit satisfactory welding of deck to supporting steel.

E. Openings required for work of other trades and not indicated on Architectural, Structural, Mechanical / Electrical / Plumbing / Fire Protection / Telecom Drawings shall be permitted only upon approval of the Design Professionals as to size and location.

F. Furnish and install tight-fitting closures at locations including but not limited to

1. Open ends of flutes and sides of decking (neoprene or sheet steel)
2. Open ends of all flutes at columns, walls and openings shown on Contract Drawings
3. Panel ends where panels change direction or abut (sheet steel or closure tape)
4. Between deck units and columns (sheet steel)
5. Between columns and exterior cladding (sheet steel)

6. Welding hole cover, with friction fastening, to close excess holes when required (sheet steel).

3.5 WELDING

A. Welding of steel deck shall follow the technique outlined by the steel deck manufacturer.

B. Welding of headed studs shall conform to all AWS requirements, including workmanship, quality control, and inspection, which shall be performed by the Contractor and observed by the Testing Agency.

3.6 ROOF SUMP PANS

Place over openings provided in roof decking and weld to top decking surface. Space welds not more than 12 inches (300mm) o.c. with at least one weld at each corner. Cut opening in roof sump bottom to accommodate drain size shown, coordinate with Plumbing Drawings.

3.7 CONCRETE PLACEMENT

A. Concrete with admixtures containing chloride salts or other deleterious materials shall not be used with steel deck.

B. Steel deck used to support concrete buggy runways shall be adequately protected against wheel damage. Decking and any runways or shoring shall be evaluated and designed by Contractor's Engineer.

3.8 TOUCH-UP

A. After installation touch-up welds on galvanized decking with specified galvanized repair paint to a dry film thickness of 2 mils, at all locations that will not receive concrete fill.

B. Touch-Up Painting: Where exposed to view, wire brush, clean, and paint scarred areas, welds, and rust spots on both surfaces of installed deck panels.

1. Touch up painted surfaces with same type of shop paint used on adjacent surfaces.
2. Where shop-painted surfaces are exposed in-service, apply touch-up paint to blend into adjacent surfaces.

3.9 CORRECTIVE MEASURES

A. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in Part 3 – CORRECTIVE MEASURES section of Specification 05 12 00.

END OF SECTION

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 GENERAL

Work of this Section shall conform to the requirements of Drawings and general provisions of the Contract, including General Conditions, Supplementary General Conditions and Division 1 Specification sections.

1.2 SCOPE

The work covered by this Section shall include all labor, material, equipment, permits, engineering and other services necessary for the installation of light gauge steel stud and joist framing as required for a complete installation in accordance with the Drawings and as specified herein. Work includes, but is not necessarily limited to the following:

1. Load-bearing steel stud framing at exterior and interior walls.
2. Non-load bearing steel stud framing at exterior walls.
3. Framing accessories.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS:

Submittals	Division 1
Quality Control	Division 1
Structural Steel	Section 05 12 00
Metal Fabrications	Section 05 50 00
Non-Structural Metal Framing	Section 09 22 16
Gypsum Board Systems	Section 09 29 00
Miscellaneous Metals	Division 5
Fireproofing	Division 7
Painting	Division 9

1.4 CODES AND STANDARDS

A. Building Code: Cold-Formed Metal Framing work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards:

1. American Society for Testing and Materials "ASTM Standards in Building Codes", various standards as referenced herein, latest edition.
2. Federal Specifications (FS).
3. American Welding Society (AWS) D1.3: “Structural Welding Code - Sheet Steel.”

4. American Iron and Steel Institute (AISI): "Specifications for the Design of Cold-Formed Steel Structural Members", latest edition.
5. Steel Stud Manufacturer's Association (SSMA), latest edition.
6. Metal Lath Association (MLA): "Specifications for Metal Lath and Furring", latest edition.
7. Society of Protective Coatings (SSPC).

C. Definitions:

See Section 05 12 00.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with fire-resistance ratings as indicated and as required by governing authorities and codes.

2. Provide materials, accessories, and application procedures which have been listed by an approved testing agency or tested according to ASTM E119 for the type of construction shown.

3. Comply with AISI requirements for design and identification of cold-formed steel.

4. Framing shall conform to the ICC Report for stud gauge and spacing for all wall conditions.

B. Steel stud system shall conform to referenced AISI documents.

C. Installer: Company specializing in performing the work of this Section with minimum 3 years' documented experience.

D. Welders: Qualified in accordance with AWS D1.3 for welding process, position, type of weld and type of steel.

1.6 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested.

(1) Submittal Schedule
(2) Shop Drawings and Erection Drawings
(3) Submittal Letter
(4) Certificate of Compliance

1. Submittal Schedule: See Section 05 12 00

2. Shop Drawings and Erection Drawings: Submit for action

a) Design calculations showing loads and other design criteria used for design of the bearing walls and shear walls, box beam headers, cross bracing and all connections not covered by standard connection details. Calculations shall include a cover letter sealed and signed by a Professional Engineer licensed in the state where the project is located for cold-formed framing to meet the design load requirements indicated on the plans.

b) A complete set of Shop Drawings prepared by the cold-formed metal framing manufacturer which includes layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Drawings shall indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work. Shop drawings shall be stamped by a professional engineer registered in the jurisdiction of the project.

3. Submittal Letter: Cold-formed framing manufacturer shall submit for record a letter accompanying the design calculations signed by their Engineer stating that they have received all structural steel Specification sections and have prepared their work in accordance with these Specifications.

4. Certificate of Compliance: Upon completion of fabrication, the cold-formed steel manufacturer shall submit for record a signed certificate of compliance stating that the work was performed in accordance with approved construction documents and with Standard Specifications and that all material meets the specified requirements.

B. Submittal Process: See Section 05 12 00.

C. Submittal Review: See Section 05 12 00.

D. Substitution Request: See Section 05 12 00.

E. Request for Information (RFI): See Section 05 12 00.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Procedures: In accordance with Section 01 60 00, “Product Requirements.”

B. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling, as required in AISI’s “Code of Standard Practice.”

C. Deliver in manufacturer’s unopened containers or bundles fully identified with name, brand, type and grade.

D. Store inside a dry, ventilated space.

1.8 JOB CONDITIONS

Coordinate stud sizes and layouts with the work of the various trades. Where ductwork, conduit, piping, casework, and other such items exceed indicated available space, increase stud sizes or make other minor modifications as necessary to accommodate the work at no change in cost of the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Acceptable Manufacturers: Any member of Steel Stud Manufacturer's Association in good standing (ICC ER-3064P).

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified Specialty Structural Engineer to design cold-formed steel framing as defined in Section 01 40 00. The design professional, individual or organization having responsibility for the design of the specialty items. This responsibility shall be in accordance with the state's statues and regulations governing the professional registration and certification of architects or engineers.

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. Deflection Limits: Design framing systems to withstand design loads without horizontal and vertical deflections greater than the following:

   a. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height.

   b. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft.

   c. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.

3. 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

4. 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 1/2 inch.

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

C. Cold-Formed Steel Framing Design Standards:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100, AISI S200 and ASTM C955, Section 8.

E. Fire-Resistance Ratings: Comply with ASTM E 119; 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.

2.3 MATERIALS

A. Cold-Formed Steel Framing, General

1. Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

a. Grade: ST33H (ST230H) and ST50H (ST340H) As required by structural performance. 33 KSI for 18 gauge (0.0428) and lighter and 50 KSI for 16 gauge (0.0538) and heavier.

b. Coating: G60, A60, AZ50 or GF30.

2. Steel Sheet for L/360 Clips: ASTM A1003/A1003M, ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

a. Grade: 33 or 50, Class 1 as required by structural performance.

b. Coating: CP 90: G90

B. Load Bearing Wall Framing

1. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, with minimum base metal thickness, flange width and section properties required to meet design requirements.

2. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and matching properties of steel studs

3. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths required, and with minimum base metal

thickness, flange width and section properties required to meet design requirements.

C. Framing Accessories

1. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

2. 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. Anchor clips.
    5. End clips.
    6. Foundation clips.
    7. Gusset plates.
    8. Stud kickers and knee braces.
    9. Joist hangers and end closures.
    10. Hole reinforcing plates.
    11. Backer plates.

D. Anchors, Clips, and Fasteners

1. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

2. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, headless, hooked bolts or headless bolts, with encased end threaded, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C or mechanically deposition according to ASTM B 695, Class 50.

3. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.

4. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

5. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

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

E. Miscellaneous Materials

1. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.

2. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

3. Non-metallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.

4. Shims: Load bearing, high-density multi-monomer plastic, and non-leaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

5. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members. Partition Stiffeners or Bridging: Unpunched channel shape, formed of 16-gauge steel to required dimensions.

2.4 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.

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

3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

1. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

2. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: 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.

2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates 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 (if required), attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials (if any).

B. After applying sprayed fire-resistive materials (if required), 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 are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to ASTM C1007 and AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. 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, screw fastening, clinch fastening, or riveting. 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 and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

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

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity 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.

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

H. Install insulation, specified in Section 07210 "Building Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

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

J. Erection Tolerances: 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.

3.4 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as indicated on shop drawings.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as indicated on shop drawings.

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

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.

2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically as 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 with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.

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.

J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

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

3.5 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing indicated on Shop Drawings.

2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches from abutting walls, and as indicated on Shop Drawings.

D. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as indicated on Shop Drawings.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.6 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. Remove and replace work where test results indicate that it does not comply with specified requirements.

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

3.7 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 A 780 and manufacturer's written instructions.

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

END OF SECTION

SECTION 05 51 19 - METAL GRATING STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Industrial Class stairs with steel-grating treads.
2. Steel railings and guards attached to metal stairs.
3. Steel handrails attached to walls adjacent to metal stairs.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

1.3 ACTION SUBMITTALS

A. Product Data: For metal grating stairs and the following:

1. Gratings.
2. Shop primer products.
3. Grout.

B. Sustainable Design Submittals:

1. Environmental Product Declaration (EPD): For each product.

C. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

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

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the State of New York in which Project is located.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design stairs, railings, and guards, including attachment to building construction.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360.

C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

    a. Uniform load of 50 lbf/ft. applied in any direction.
    b. Concentrated load of 200 lbf applied in any direction.
    c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

    a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..

b. Infill load and other loads need not be assumed to act concurrently.

3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Steel Bars for Grating Treads: ASTM A36/A36M or steel strip, ASTM A1011/A1011M or ASTM A1018/A1018M.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [**25**] <**Insert value**> percent.

D. Steel Wire Rod for Grating Crossbars: ASTM A510/A510M.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

E. Aluminum Bars for Grating Treads: ASTM B221 extruded aluminum, alloys as follows:

1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
2. 6061-T1, for grating crossbars.
3. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

F. Steel Tubing for Railings and Guards: ASTM A500/A500M (cold formed) ASTM A513/A513M.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
2. Provide galvanized finish for exterior installations and where indicated.

G. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

H. Provide galvanized finish for exterior installations and where indicated.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 where built into exterior walls.

1. Select fasteners for type, grade, and class required.

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

C. Post-Installed Anchors: Torque-controlled expansion anchors chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for interior exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, railings, guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Assemble stairs, railings, and guards in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish # 3 - Partially dressed weld with spatter removed.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that are exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.6 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers of steel plates or channels.

a. Stringer Size: As required to comply with "Performance Requirements" Article.
b. Provide closures for exposed ends of channel stringers.
c. Finish: Painted Galvanized.

2. Construct platforms and tread supports of steel plate channel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.

a. Provide closures for exposed ends of channel framing.
b. Finish: Painted Galvanized.

3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers.

C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."

1. Fabricate treads and platforms from welded steel or pressure-locked steel grating with openings in gratings no more than 3/4 inch in least dimension.

a. Surface: Serrated.
b. Finish: Painted Galvanized.

2. Fabricate grating platforms with nosing matching that on grating treads.

a. Secure grating to platform framing by welding.

D. Risers: Open.

E. Toe Plates: Provide toe plates around openings and at edge of open-sided floors and platforms, and at open ends and open back edges of treads.

1. Material and Finish: Steel plate to match finish of other steel items.
2. Fabricate to dimensions and details indicated.

2.7 FABRICATION OF STAIR RAILINGS AND GUARDS

A. Comply with applicable requirements in Section 05 52 13 "Pipe and Tube Railings."

B. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required.

1. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

C. Close exposed ends of railing and guard members with prefabricated end fittings.

D. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

E. Connect posts to stair framing by direct welding unless otherwise indicated.

F. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.

1. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

A. Finish metal stairs after assembly.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:

1. Exterior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION OF METAL STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

1. Grouted Baseplates: Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces.

a. Clean bottom surface of baseplates.
b. Set steel-stair baseplates on wedges, shims, or leveling nuts.
c. After stairs have been positioned and aligned, tighten anchor bolts.
d. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.
e. Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

1) Neatly finish exposed surfaces; protect grout and allow to cure.
2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
3. Comply with requirements for welding in "Fabrication, General" Article.

3.2 REPAIR

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 51 19

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel pipe and tube railings.

B. Related Requirements:

1.2 COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

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

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

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

1. For installed products indicated to comply with performance requirements and design criteria, submit shop drawings signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples: Submit samples for each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the Work.

1. 6-inch- long sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. 6-inch- square sections of Perforated sheet steel infill.
4. 6-inch- square sections of Wire mesh guardrail infill.
5. 6-inch- square sections of Expanded metal guardrail infill.

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

1.4 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications: A firm experienced in producing handrails and railings similar to those indicated for this Project for a minimum of 5 years, with a record of successful in-service performance, with sufficient production capacity to produce required units without causing delay in the work.
1. Employ only experienced tradesmen for both fabrication and installation, who are capable of producing work of the highest standards of quality in the industry.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of handrails and railings that are similar to those indicated for this Project in material, design, and extent.

C. Source Limitations: Obtain each type of railing from single source from single manufacturer.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 STORAGE, DELIVERY AND HANDLING

A. Store railings in a dry, well-ventilated, weathertight place. Deliver and handle so as to prevent any type of damage to the fabricated work.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with pipe and tube railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel: 72 percent of minimum yield strength.

C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

3. Deflection Criteria: The larger deflections at the top from either the horizontal live loads or applicable wind loads shall be the lesser of 3/4-inchor h/90 for cantilever elements, and h/175 for simple span elements, where h is the distance from the floor level to the top of guardrail. Applied loads shall be allowable stress design loads.

D. Exterior Metal Fabrications: All exterior metal stairs shall be fabricated and installed to prevent buckling, opening up of joints and overstressing of welds and fasteners under the following temperature conditions:

1. Base fabrication on a temperature of +70 deg F at time of installation with allowance made for an exposed metal surface temperature range of -5 to +180 deg F
. Make all necessary adjustments and provisions for concealed expansion.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

F. Regulatory Requirements: Comply with the requirements of Part 1910 of the Occupational Safety and Health Standards (OSHA), the American Disabilities Act (ADA), and local regulatory requirements as applicable to stairs, handrails and the protection of openings; where regulatory requirements conflict the more stringent shall apply.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without pitting, seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes where exposed to view on finished units.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.3 STEEL AND IRON

A. General: Provide steel and iron (ferrous metal) in the form indicated, complying with the following requirements.

B. Pipe: ASTM A 53/A 53M, Type S – Seamless, Grade A, suitable for close coiling or cold bending, Standard Weight (Schedule 40) minimum, unless another grade and weight are required to suit performance requirements.

1. Galvanized finish for exterior installations and where indicated.

C. Tubing: ASTM A 500 (cold formed) Grade A or ASTM A 513, unless otherwise indicated or required to satisfy the performance requirements.

D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

1. Welded Headed Studs: AWS D1.1 (Type A or B as selected by fabricator), ASTM A 108 Grades 1010 through 1020 inclusive and bearing the minimum mechanical properties for studs as selected by fabricator to suit performance requirements.

E. Cold Finished Steel Bars: ASTM A 108, grade as selected by fabricator.

F. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4 FASTENERS

A. General: Provide the following:

1. Galvanized Steel Railings: Plated fasteners complying with ASTM B 633, or ASTM F 1941, Class Fe/Zn 12 for zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of complying with the performance requirements.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
2. Provide square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion or adhesive anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Exterior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

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

B. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to comply with the performance requirements.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Shear, cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with either welded or nonwelded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings. Weld connections continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.

4. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: partially dressed weld with spatter removed.

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

J. Form changes in direction as indicated on the Drawings.

K. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Fabricate joints that will be exposed to weather in a watertight manner.

N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns.

O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

Q. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

R. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

S. Gates: Form gates from steel pipe of same size and shape as top rails, with infill to match guards. Provide with spring hinges for fastening to wall and overlapping stop with rubber bumper to prevent gate from opening in direction opposite egress.

1. Cut, reinforce, drill, and tap components, to receive gate hardware, screws, and similar items.

T. Provide minimum 3/8 inch diameter weep holes or another means to drain entrapped water in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources.

2.7 FINISHES, GENERAL

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

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

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

2.8 STEEL AND IRON FINISHES

A. Galvanized Railings: Hot-dip galvanize exterior steel and iron railings to comply with ASTM A 123. Hot-dip galvanize hardware for exterior steel and iron railings to comply with ASTM A 153/A 153M.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
3. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.

C. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

D. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

E. Primer Application: Apply shop primer to prepared surfaces of railings, except those with galvanized finishes and those to be field welded, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

F. Do not deliver primed railing work until primer has dried.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION, GENERAL

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

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required to meet or exceed the performance requirements.

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

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Leave anchorage joint exposed with 1/8 inch buildup, sloped away from post

D. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows.

1. Anchor posts to steel by welding directly to steel supporting members.

E. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

A. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

B. Secure wall brackets and railing end flanges to building construction as required to meet or exceed the performance requirements and the following:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to satisfy the performance requirements.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.7 PROTECTION

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

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 52 13

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes miscellaneous carpentry.

1.2 ACTION SUBMITTALS

A. Product Data: Submit product data for each type of process and factory-fabricated product indicated.

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

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; for lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Regional Materials: Dimension lumber, except treated materials, shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

B. Certified Wood: Lumber and plywood shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.

C. Lumber: Comply with DOC PS 20 "American Softwood Lumber Standard" and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.
4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

D. Wood Panels:

1. Plywood: Comply with DOC PS 1 "Construction and Industrial Plywood" for plywood panels. Use exterior grade for panels in wet conditions.
2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Provide chemical fire retardant process tested and labeled by UL with flame spread and smoke developed ratings of 25 or less. Comply with performance requirements in AWPA U1, Use Category UCFA as a minimum for pressure treatment. Size wood before treatment so that minimum cutting will be required after treatment. Kiln dry lumber to a maximum 19 percent moisture content, kiln dry plywood to a maximum 15 percent moisture content, after treatment. Treat indicated items and the following:

1. Wood members required to be treated by Building Code having jurisdiction at the site and wood members specified as fire-retardant-treated.

B. Identify fire-retardant-treated wood with appropriate classification marking of UL.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground.

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

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

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

2.4 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber for support or attachment of other construction, including blocking, nailers, and similar members.

B. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
2. Western Woods; WCLIB or WWPA, No. 2 Grade.

2.5 PANEL PRODUCTS

A. Concealed Plywood for Countertop Underlayment:

1. APA Exterior sheathing, manufactured with no added urea-formaldehyde, in thickness as indicated but not less than 3/4 inch.

a. Roseburg Forest Products; Oregon Plywood 2 softwood plywood sheathing.
b. Roy O. Martin Lumber Company, Limited Partnership (MARTCO), Plywood Division; exterior softwood plywood sheathing.
c. Potlatch Forest Products Corporation, Forest Products Div., exterior softwood plywood sheathing.

B. Medium-Density Fiberboard (Moisture Resistant): A sustainable, moisture-resistant, medium density fiberboard (MDF) panel manufactured from minimum 92 percent preconsumer recycled wood fiber complying with ANSI A208.2, Grade 155, having a minimum 48 pcf density except that minimum for screw holding capacity on face shall be 325 pounds; an ASTM E 84 Class C flame spread rating, minimum 3/4 inch thick, edged and faced as specified, fabricated with binder containing no added urea formaldehyde.

1. Roseburg Forest Products; NAUF FSC Certified Medex.

C. Telephone, Data, Security, Stretched Fabric Wall System Artwork Blocking, Mirror,and Electrical Equipment Backing Panels:

1. APA, Exposure 1, C-C Plugged, fire-retardant treated, manufactured with no added urea-formaldehyde, in thickness indicated or, if not indicated, not less than 3/4 inch thick.

D. Medium-Density Fiberboard (fire rated): A sustainable, fire rated, medium density fiberboard (MDF) panel manufactured from minimum 82 percent recycled wood fiber complying with ANSI A208.2, Grade 130, having a minimum 48 pcf density except that minimum for screw holding capacity on face shall be 250 poundsan ASTM E 84 Class A flame spread rating, minimum 3/4 inch thick, edged and faced as specified, fabricated with binder containing no added urea formaldehyde.

1. Roseburg Forest Products; NAUF FSC Certified Medite FR.

2.6 FASTENERS

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

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

C. Nails, Wire, Brads, and Staples: Select material, type, size, and finish required for each use.

1. ASTM F 1667 for driven fasteners such as nails, spikes and staples.
2. ASTM F 547 for nails used with wood and wood based products.

D. Wood Screws: Select material, type, size, and finish required for each use. Comply with ASME B18.6.1.

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

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

PART 3 - EXECUTION

3.1 INSTALLATION

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

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

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

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 PANEL PRODUCT INSTALLATION

A. General: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," and local utility requirements, if any, for plywood backing panels utilized as indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Countertop Underlayment: Bolt to miscellaneous steel framing.
2. Plywood Backing Panels: Secure to wall using proper fastening devices for substrates encountered spaced 12 inches on center maximum at perimeter 1/2 inch from corners and three rows of 3 fasteners each in the backerboard field. Countersink fasteners flush with plywood surface. Butt adjacent panels without lapping.

END OF SECTION 06 10 53

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Parapet sheathing.
4. Sheathing joint and penetration treatment.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for plywood backing panels.
2. Section 07 25 00 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier and water-resistant glass-mat gypsum sheathing requirements and installation, special details, transitions, mockups, air-leakage testing, protection, and work scheduling that covers air-barrier and water-resistant glass-mat gypsum sheathing.

1.3 ACTION SUBMITTALS

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

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

5. For air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

B. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.

C. Shop Drawings: For air-barrier and water-resistant glass-mat gypsum sheathing assemblies.

1. Show locations and extent of sheathing, accessories, and assemblies specific to Project conditions.
2. Include details for sheathing joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.

B. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.

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

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Air-barrier and water-resistant glass-mat gypsum sheathing.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications:

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

1.6 PRECONSTRUCTION TESTING

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

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested in accordance with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber plywood are to be tested in accordance with ASTM D5516, and design value adjustment factors are to be calculated in accordance with ASTM D6305. Span ratings after treatment are not to be less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F are not to be less than span ratings specified.

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

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat all plywood unless otherwise indicated.

2.3 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C1177/C1177M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Certainteed; SAINT-GOBAIN.
    b. Continental Building Products, LLC.
    c. Georgia-Pacific Gypsum LLC.
    d. National Gypsum Company.
    e. USG Corporation.

2. Type and Thickness: Type X, 5/8 inch thick.
3. Size: 48 by 96 inches for vertical installation.

2.4 ROOF SHEATHING

A. Plywood Roof Sheathing: , Exterior, Structural I sheathing.

1. Span Rating: Not less than 32/16.
2. Nominal Thickness: Not less than 1/2 inch.

2.5 PARAPET SHEATHING

A. Glass-Mat Gypsum Parapet Sheathing: ASTM C1177/C1177M.

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

    a. Certainteed; SAINT-GOBAIN.
    b. Georgia-Pacific Gypsum LLC.
    c. National Gypsum Company.
    d. USG Corporation.

2. Type and Thickness: Type X, 5/8 inch thick.
3. Size: 48 by 96 inches 48 by 108 inches 48 by 120 inches 1200 by 2400 mm 1200 by 2750 mm 1200 by 3050 mm for vertical installation.

2.6 FASTENERS

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

1. For roof parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

G. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours in accordance with ASTM B117. Provide washers or plates if recommended by sheathing manufacturer.

2.7 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

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

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

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall parapet and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with screws.
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

E. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

F. Air-Barrier and Water-Resistant Glass-Mat Gypsum Sheathing:

1. Install accessory materials according to sheathing manufacturer's written instructions and details to form a seal with adjacent construction, to seal fasteners, and ensure continuity of air and water barrier.

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

2. Connect and seal sheathing material continuously to air barriers specified under other Sections as well as 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.

3. 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.
4. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply preformed silicone extrusion, so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

    a. Transition Strip: Roll firmly to enhance adhesion.
    b. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.

5. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of sheathing material with foam sealant.
6. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
7. Seal top of through-wall flashings to sheathing with an additional 6-inch- wide, transition strip.
8. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
9. Repair punctures, voids, and deficient lapped seams in strips and transition strips extending 6 inches beyond repaired areas in strip direction.

3.3 CEMENTITIOUS BACKER UNIT INSTALLATION

A. Install panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.

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

C. Inspections: Air-barrier and water-resistant glass-mat gypsum sheathing, 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. 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.
3. Termination mastic has been applied on cut edges.
4. Strips and transition strips have been firmly adhered to substrate.

5. Compatible materials have been used.
6. Transitions at changes in direction and structural support at gaps have been provided.
7. Connections between assemblies (sheathing and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
8. All penetrations have been sealed.

D. Tests: As determined by testing agency from among the following tests:

1. Air-Leakage-Location Testing: Air-barrier sheathing assemblies will be tested for evidence of air leakage in accordance with ASTM E1186, chamber pressurization or depressurization with smoke tracers.
2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate in accordance with ASTM E783 or ASTM E2357.

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

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

G. Prepare test and inspection reports.

END OF SECTION 06 16 00

SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes interior architectural woodwork:

1. Plastic-laminate cabinets.
2. Plastic-laminate countertops.
3. Solid-surfacing material countertops.
4. Wood cabinets.
5. Wood paneling.
6. Closet and utility shelving.
7. Interior frames and jambs.
8. Interior standing and running trim.
9. Shop priming of interior woodwork to receive painted finish.
10. Shop finishing of interior woodwork to receive opaque finish.
11. Shop finishing of interior woodwork to receive transparent finish.
12. Upholstery seating

B. Refer to Division 01 Sections for requirements regarding:

1. LEED credit achievement goals as summarized by the LEED Scorecard attached to Section 01 81 13, “Sustainable Design Requirements.”

2. Requirements for documentation of LEED credits.

3. Payment application requirements as they relate to LEED documentation requirements

C. Related Requirements:

1. Section 06 10 53 "Miscellaneous Rough Carpentry" for concealed blocking for millwork items.

1.2 ACTION SUBMITTALS

A. Product Data: Submit product data for each material and product specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

1. Cabinet hardware and accessories.
2. Handrail brackets.
3. Glass products and glazing materials.
4. Finishing materials and processes.

5. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
6. Include submittal of stone sealer manufacturer's recommended methods for application of impregnator and surface protection coatings based on testing of project specific stone countertop materials.

B. Submittals for LEED:

1. Completed "LEED Criteria Worksheet," for each component material of the product or assembly used in the installation of Work of this Section. Refer to Division 01, "Sustainable Design Requirements."

2. Credit IEQ 4.xx for VOC Content: Submit product data for VOC content of all on-site installation adhesive products provided under this Section.

    a. Provide documentation on supplier's letterhead of the VOC content of each product provided under this Section. Express quantity in g/L or the unit of measurement used in the applicable LEED Reference Guide for that particular type of product.

3. Credit IEQ 4.xx for Low Emitting Materials:

    a. Submit all documentation required by the USGBC to document that the bonding agent used in each composite-wood product provided for this project contains no urea formaldehyde. Submit this documentation on the letterhead of the supplier for the composite wood product incorporated into the Work.

    b. Submit all documentation required by the USGBC to document that the adhesive used to fabricate the work of this Section contains no urea formaldehyde. Submit this documentation on the letterhead of the supplier of the adhesive products incorporated into the Work.

4. Credit MR 4.xx and Credit ID for Recycled Content:

    a. Weight Component Documentation: For material assemblies or products having recycled content submit documentation indicating the weight of the material assembly or product and the percentages by weight of post-consumer and pre-consumer recycled content of the material assembly or product. The recycled fraction of the material assembly or product will be multiplied by the total cost of the material assembly or product to determine the recycled content value as prescribed by LEED protocol. Document the weight of the material assembly or product and the post-consumer and pre-consumer recycled contents on the letterhead of the supplier of the material assembly or product.

    b. Cost Component Documentation: Provide the material cost for every component that comprises a material assembly or product that is composed of recycled content provided under this Section. Document the material cost on the letterhead of the supplier for each material assembly or product.

5. Credit MR 5.xx and Credit ID for Local/Regional Materials: Provide the location of manufacture and/or final assembly for each locally/regionally extracted, processed, and manufactured material incorporated into the Work. Locally/regionally extracted or processed is defined as materials having their source as a raw material from within a 500 miles radius of the site. Locally/regionally manufactured is defined as materials having been assembled as a finished product within a 500 miles radius of the project site. Assembly does not include on-site assembly, erection or installation of finished components, as in structural steel, miscellaneous iron or systems furniture. For building materials or products shipped in part by rail or water, the total distance to the project shall be determined by weighted average, whereby the portion of the distance transported by rail is divided by 3, the portion of the distance transported by inland waterways is divided by 2, the portion of the distance transported by sea is divided by 15, and added to the portion of the distance transported by any other means other than by rail, inland waterways, sea, or road, provided the total weighted average distance does not exceed 500 miles (800 kilometers).

    a. Location Documentation: Include distance from the location of manufacture and/or final assembly to the project site for each locally/regionally extracted, processed, and manufactured material incorporated into the work. If only a fraction of the material is extracted and manufactured locally, indicate the percentage by weight. Submit this documentation on the letterhead of the supplier for each locally/regionally extracted, processed, and manufactured material incorporated into the Work.

    b. Cost Documentation: Include a printed statement of cost for each regionally extracted, processed, and manufactured material. Submit this documentation on the letterhead of the supplier for each locally/regionally extracted, processed, and manufactured material incorporated into the Work.

6. Credit MR.xx for Certified Wood: Provide all documentation as required by the US Green Building Council (USGBC) to prove that all certified wood products furnished under this Section are FSC, including chain of custody certification provided by one of the following third party reviewers whom are identified in the applicable LEED Reference manual. Include statement indicating costs for each certified wood product. Submit this documentation on the letterhead of the supplier for each FSC product incorporated into the work.

    a. Smart Wood.
    b. Scientific Certification Systems (SCS).

C. Shop Drawings: Submit shop drawings showing locations of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components. Elevations shall be drawn at a scale of not less than 1/2" = 1'-0" . Details shall be drawn at a scale of not less than 3" = 1'-0" .

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

2. Show locations and sizes of cutouts and holes for plumbing, electrical, computer and telephone equipment and other items installed in architectural woodwork.
3. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

D. Samples: Submit samples of the following:

1. Five veneer leaves representative of and selected from each flitch to be used for transparent-finished woodwork.
2. Three 12 inch by 12 inch sample sets containing a minimum of two or more samples of transparent finished wood-veneer and plastic laminate veneered panel products, fabricated from each core product, for each veneer specified and demonstrating the proposed full range of appearance characteristics to be expected in completed work. Include at least one face-veneer seam in each sample.
3. Lumber and panel products for transparent finish, for each species and cut, finished on one side and one edge. Furnish lumber in 12 inch lengths, furnish panel samples in 12 inch squares.
4. Lumber and panel products with shop-applied opaque finish, for each finish system and color, with exposed surface finished. Furnish lumber in 12 inch lengths, furnish panel samples in 12 inch squares.
5. Thermoset decorative-overlay surfaced panel products, for each type, color, pattern, and surface finish.
6. Solid-surfacing materials, 6 inches square.
7. Cabinet Locks: Three samples of each type.
8. Metal Trim Shapes: Three samples of each type and finish, 12 inches long.
9. Submit samples of each type of door specified showing construction and finishes selected. Samples shall be 12 inch by 12 inch corner section.

1.3 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Instructions: Submit maintenance instructions for all countertop materials. Where countertop materials are recommended to be protected with hot pads, provide manufacturers recommended hot pad product properly sized for the hot equipment designed to be placed thereon.

1.5 QUALITY ASSURANCE

A. Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer - acceptable to the Architect - to assume undivided responsibility for woodwork specified in this Section, including fabrication, finishing, and installation. The manufacturer shall have a minimum of 15 years successful experience in the custom fabrication and installation of architectural woodwork comparable to that shown and specified, be a member of the AWI, maintain an organized quality control program, perform its own in-house veneer lay-up work, and who retains facilities with sufficient capacity and quality to produce the required architectural woodwork without causing delay to the Project.

B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

D. Quality Standard: Fabricate and install all architectural woodwork in accordance with the applicable requirements of Architectural Woodwork Standards, 2nd edition, published jointly by AWI, AWMAC, and WI, unless more stringent requirements are specified or shown.

E. Fire Performance Characteristics: Provide materials identical to those tested for the following fire performance characteristics per ASTM test methods indicated by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify treated lumber with classification marking of inspecting and testing organization in the form of separable paper label or, where required by authorities having jurisdiction, of imprint on lumber surfaces that will be concealed from view after installation.

1. Surface Burning Characteristics for Concealed Blocking, Furring, and Door Subframing: Not exceeding a flame spread of 25, and smoke developed of 50 when tested per ASTM E 84 for 30 minutes.
2. The fire performance finish requirements for all exposed interior wall and ceiling woodwork (including the paneling but not limited to paneling) substrates in fully sprinklered spaces shall be as follows which has been taken from the IBC [**2012**] [**2015**] [**2018**], Table 803.9. Footnotes to Table 803.9 that are pertinent to the project are also made a part of this specification.

Use Group	Interior Exit	Corridors and	Rooms and Enclosed

	Stairways, Exit Ramps, and Exit Passageways	Enclosures for Exit Access Stairways, and Exit Access Ramps	Spaces
A-1, and A-2	Class B	Class B	Class C
A-3	Class B	Class B	Class C
B, E, M, R-1	Class B	Class C	Class C
S	Class C	Class C	Class C

Class B: Flame spread 26-75, smoke developed 0-450 when tested in accordance with ASTM E 84.
Class C: Flame spread 76-200, smoke developed 0-450 when tested in accordance with ASTM E 84.
Forest Certification: Provide interior architectural woodwork produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

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

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify actual dimensions of other construction by accurate field measurements before fabrication of woodwork; and indicate measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on shop drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

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

1.9 PREINSTALLATION COORDINATION MEETING

A. Meet at the Project site, prior to installation of architectural woodwork, to review the substrate preparation, installation and coordination with other trades, special details and conditions, and other topics related to the architectural woodwork. The preinstallation meeting shall include the Architect, the Contractor, architectural woodworker, and any subcontractors affected by the architectural woodwork installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of the AWS quality standard for each type of woodwork and quality grade specified.

B. Regional Materials: The following wood products shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

1. Interior plywood paneling.
2. Shelving and clothes rods.

C. Certified Wood: The following wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.

1. Interior plywood paneling.
2. Shelving and clothes rods.

D. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

E. Lumber Standards: Comply with applicable provisions for grading and workmanship of AWS Architectural Woodwork Standards, Section 3, and the requirements shown and specified; where standards conflict the more stringent shall apply. Provide lumber surfaced 4 sides (S4S) and fabricated to profiles shown. All lumber shall be kiln dried to the moisture content indicated in AWS, Section 2.

1. Furring, Blocking, Shims: No. 1 Common; Southern Pine.
2. Door Subframes: No. 1 Common Southern Pine, fire retardant treated to reduce combustibility.

F. Wood Veneers:

1. Species, Matching, and Cut for Transparent Finish: Complying with AWS, Section 4, and the following:

a. [**(WD##)**] Specie and figuring as indicated on the Finish Schedule, book matched unless otherwise indicated, minimum 5 inch width leaves, complying with HPVA HP-1, Grade AA, matching Architect's sample.

G. Wood Panel Products:

1. Medium-Density Fiberboard (moisture resistant): A moisture-resistant, medium density fiberboard (MDF) panel manufactured from wood fiber complying with ANSI A208.2, Grade 155, having a minimum 48 pcf density except that minimum for screw holding capacity on face and edge shall be 275 poundsand 225 poundsrespectively; an ASTM E 84 Class C flame spread rating, minimum 3/4 inches thick, edged and faced as specified, fabricated with binder containing no added formaldehyde.

a. Roseburg Forest Products; FSC Certified Medex.
b. Arauco North America; Moisture Resistant Trupan.
c. Uniboard, Canada; Uniboard NU Green MR50 MDF.

H. Thermoset Decorative Overlay (Melamine): Particleboard or medium-density fiberboard with surface of thermally fused, melamine-impregnated decorative paper complying with the recommendations of the Composite Panel Association's Technical Bulletin "Laminating Composite Panels."

1. Face Colors: As indicated in the Finish Schedule on the Drawings.

I. Glass: Clear tempered float glass, complying with ASTM C 1036, Type I, Class 1, Quality q3, and ASTM C 1048 Kind FT, thickness as indicated.

1. Prior to tempering, cut glass to required sizes and profiles as determined by accurate measurement of supporting standoff hole locations.

2. Hole Cutting: Unless otherwise recommended by the glass manufacturer, comply with the requirements of ASTM C 1048, Article 7.8 for hole placement, minimum hole diameter, and dimensional tolerances of holes and this specification. Unless otherwise recommended by the glass manufacturer, locate holes not less than 4 inches from glass edges, hole diameter shall be at least 1/8 inch larger than the shank of the screw fastener and screw sleeve spacers used for the rosette assemblies. Chips and flakes at hole edges shall not be permitted, and the inner surfaces of holes shall be smooth polished to match glass panel edges.
3. Edge Treatment: All glass edges shall have an arrised edge profile (small bevel of width not exceeding 1/16 inch at an angle of approximately 45 degrees to the surface of the glass) with a polished (surface is reflective in appearance similar to the major surface of glass) surface.

J. High-Pressure Decorative Laminate[**(PL##)**]: Complying with NEMA LD 3 for Horizontal General Purpose Grade (HGS) typically and Vertical General Purpose Grade (VGS) where specified. Nominal thickness for HGS and VGS laminates to be 0.048 inches +/-0.005 inches and 0.028 inches +/- 0.004 inches, respectively. Where high pressure decorative laminate is indicated to be faced with aluminum, provide aluminum sheet goods specifically made for laminating to vertical MDF and particleboard substrates in sheet thickness of 0.025 inches +/- 0.002 inches.

1. Types: As indicated in the Finish Schedule on the Drawings.

    a. Provide factory applied protective peel coat to prevent surface damage during fabrication and handling of aluminum faced decorative laminates. Remove protective peel coat after installation in accordance with the manufacturer's recommendations. If the film is left in place after installation, exposure to direct sunlight for a prolonged period may cause a paste residue and create other problems.

2. Backing Sheets: Non-decorative, high pressure laminate, NEMA LD3, Grade, types and thickness to match face sheets and equalize pull.

K. Countertop Sealer:

1. Impregnator: Low viscosity, UV resistant, water vapor permeable, impregnator specifically formulated to penetrate stone and grout pore structures without changing the color or sheen of the stone to which it is applied and that provides an invisible barrier of protection from water, dirt, oil, grease, lipstick, wine, and hand cream lotion infiltration.

    a. .Basis of Design Product: S234 Impregnator for factory sealing of stone countertop units, if field finishing stone countertops use S232 Impregnator. Contact HMK Stone Care System c/o ACI International, Hallandale, FL. (800) 424-2HMK, (954) 964-1658.
    b. Lithofin, Lithofin MM Stainstop Impregnator for factory sealing.
    c. Miracle Adhesives: Miracle 511 Pourous Plus for factory sealing.

2. Surface Protection Coating: No-rinse type, 100 percent natural vegetable soap cleanser, that is pH neutral (pH 7), vapor permeable and compatible with impregnator, and that emulsifies dirt and debris on the stone surface while repelling liquids. Will not change the color or sheen of the stone to which it is applied.

    a. Basis of Design Product: HMK P324 Liquid Stone Soap No Rinse.
    b. Lithofin, Surface protection coating complying with the above requirements and recommended by the impregnator manufacturer.
    c. Miracle Adhesives: Surface protection coating complying with the above requirements and recommended by the impregnator manufacturer.

3. Prepare countertop surfaces to receive sealer in accordance with the countertop sealer manufacturer's recommendations. Apply sealers and surface protection coatings in accordance with the countertop sealer manufacturer's instructions.

L. Solid-Surfacing Material[**(SO##)**]: Provide material that meets or exceeds ISFA-2-01 performance standards, consisting of reacted monomers and resins, mineral fillers and pigments and manufactured in sheets of specific thicknesses. Solid surfacing material shall be solid, non-porous, homogeneous, hygienic, renewable, and, when applicable, may feature inconspicuous hygienic seams. Solid surfacing material shall be free from conspicuous internal strengthening fibers.

1. Types: As indicated in the Finish Schedule on the Drawings.

M. Adhesives, General: Use only low emitting VOC adhesives that leave no glue lines on finished surfaces of architectural woodwork. Do not use adhesives that contain urea formaldehyde.

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

    a. Wood Glues: 30 g/L.
    b. Contact Adhesives: 80 g/L.

N. Solid Laminate: Solid composite panels fabricated of material specifically designed for casework. All panel surfaces shall be electron beam cured to prevent damage from cleansing agents such as graffiti removers. Surfaces shall offer protection against 10 percent hydrochloric acid, 10 percent phosphoric acid, 30 percent hydrogen peroxide, 25 percent caustic soda, 100 percent paint thinner and 100 percent methyl ethyl ketone without functional or aesthetic damage to the surface. All surfaces and edges shall be non-porous.

1. Core: Solid black.
2. Physical Properties:

    a. Modulus of elasticity: 1,500,000-psi minimum.
    b. Shear strength: 2000-psi minimum.

c. Compressive strength: 24,000-psi minimum.
d. Weight: 93 lbs. per cubic foot maximum.
e. Tensile strength: 13,000-psi minimum.
f. Flexural strength: 16,000-psi minimum.
g. Surface Impact Resistance: 9 lb.
h. Scratch Resistance: 0.8 lb.
i. Specific Gravity: 87 lbs. per cubic foot, minimum.
j. Dimensional Stability: 0.03 in/ft, maximum.
k. Water Absorption: 3 percent by weight, maximum.

3. Thickness, Products and Manufacturer: Trespa North America, Inc. subsidiary of Trespa International BV, Netherlands; Trespa Virtuon, thickness, colors and surface texture as indicated in the Finish Schedule on the Drawings.

O. Cushions at Corridor and Classroom Niche Seating: Custom fabricate seating cushions to the sizes, shapes, and profiles indicated. Cushions shall be composed of high density/high compression polyurethane foam core , with a compression and density as selected by the fabricator that is anti-warping and which is suitable for the application indicated, wrapped with a fabric lining and fully Vinyl upholstered with blind stitching at seams. The cushions shall be secured in place with two component Velcro type tape, unless otherwise detailed. The tape shall be fully concealed beneath the cushions with one component of the tape securely stitched to the cushion and the other adhesively affixed to the solid bench structure.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where indicated, use materials impregnated with fire-retardant chemical formulations indicated by a pressure process or other means acceptable to authorities having jurisdiction to produce products with fire-test-response characteristics specified.

1. Do not use treated material that does not comply with requirements of referenced woodworking standard. Do not use twisted, warped, bowed, discolored, or otherwise damaged or defective lumber or panel products.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.

B. Fire-Retardant-Treated Lumber: Materials impregnated with fire-retardant chemical formulations to comply with AWPA U1, Use Category UCFA. Kiln-dry material after treatment to levels required for untreated woodwork.

C. Fire-Retardant Particleboard: Panels made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture and complying with fire-test-response characteristics specified.

D. Fire-Retardant Fiberboard: ANSI A208.2 medium-density fiberboard panels made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture and complying with fire-test-response characteristics specified.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials for a complete installation of architectural woodwork, except for items specified in Section 08 71 00 "Door Hardware."

B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

C. Frameless Concealed Hinges for Cabinet Doors (European Type): Concealed all-metal furniture hinges adaptable or engineered for 35 mm hinge cup boring pattern, with minimum 155 degree opening angle, three-dimensional hinge having adjustments located in the steel hinge arm, steel or die-cast zinc hinge cups, mounting plates, and plastic insertion dowels to receive hinge screws. Automatic soft closing shall engage only in the last 10 degrees of swing. All hinge pins and linkages shall be hardened. Complying with BHMA A156.9, B01602. Bright nickel finish (US15).

1. Hinge Quantity: Provide hinge quantity as recommended by hinge manufacturer based on cabinet door width, weight, thickness, door material, and hinge cup selection.
2. Metal Furniture Hinge Products and Manufacturers: One of the following:

    a. Basis of Design: Grass Tiomos Series; Grass America, Inc.; Kernersville, NC.
    b. Blumotion Series; Blum USA; Stanley, NC.
    c. Salice; Silencia Series 200.

D. Hidden Gate Hinges: Full mortised, invisible hinges and specifically manufactured for door thickness indicated and fabricated from high strength plated brass or steel, heavy duty zinc alloy or brass castings, and non-removable riveted hinge pins. Each hinge shall be engineered for smooth performance with laminated link construction supplemented by anti-friction materials that reduce friction for smooth, free hinge operation. Complying with BHMA A156.9, B01501.

1. Hinge Quantity: Provide hinge quantity as recommended by hinge manufacturer based on cabinet door width, weight, thickness, door material, and hinge cup selection.
2. Metal Furniture Hinge Products and Manufacturers: One of the following:

    a. Basis of Design: "Soss" Hinges; Universal Industrial Products Company, Pioneer, OH.
    b. Vici Hinges 341.25.xxx; Hafele America; Archdale, NC.
    c. Soss Hinge 341.07.xxx; Hafele America Co.; Archdale, NC.

E. Wire Pulls: Back mounted, 4 inches long, 3/8 inches in diameter fabricated from satin finished stainless steel (US32D), complying with BHMA A156.9, B52011, unless otherwise indicated.

F. Edge Pulls: Full mortised, solid, bronze or brass door edge pull, with 1/2 inch finger clearance, 1/4 inch diameter roll diameter, having nominal overall roll length dimension of 3 inches long, with backbend drilled and countersunk to receive 2 screw fasteners; form for full mortise application; satin finished chrome (US26D); one of the following:

1. SRO Style Edge Pull; Tydix Products, Inc.
2. DP3A Tab Drawer Pull; Doug Mockett and Co., Inc.

G. Catches: Magnetic, complying with BHMA A156.9, B03141 for single doors and B03161 for double doors.

1. For Single Doors:One of the following:

   a. CD41 Single Magnetic Cabinet Catch; Stanley Commercial Hardware.
   b. 900; Rockwood Manufacturing Company, Rockwood, PA.
   c. 246.94.701 housing x 246.94.702 counterpiece; Hafele America Co. Archdale, NC.

2. For Double Doors: One of the following:

   a. 901; Rockwood Manufacturing Company.
   b. CD45 Double Magnetic Cabinet Catch; Stanley Commercial Hardware.

H. Cabinet Shelf Rests: Nickel plated brass or steel, or stainless steel, minimum 6 mm diameter shelf support pegs in sockets, complying with BHMA A156.9, B04013. One of the following:

1. Hafele 282.01.701 x 282.50.704; Hafele America, Co.
2. K-10S with K-2 Sleeve; Brusso, Inc.
3. 331 Series Flat Top Shelf Support Pin with 325 Series Insert Grommet; Knape and Vogt.

steel ball bearing, side mounting, 100 pound (45 kg) capacity medium duty load rating, cold rolled steel slide members and ball retainers, cushioned in and outstops, detent-in, progressive action, positive stop, bright electro zinc plate finish. www.accuride.com

I. Closet Rods and Flanges: 1-1/2 inch (38 mm) diameter, satin finished chrome plated steel or satin finished stainless steel with matching end flanges.

J. Adjustable Shelf Standards and Brackets for Wall-Hung Open-Shelving:

1. Standards: Model No. 87 ANO Extra Heavy Duty 87-187 Series; [24 inch] [36 inch] [48 inch] [60 inch] [72 inch] [84 inch] [96 inch] [144 inch] lengths [**as indicated**], by Knape and Vogt.
2. Brackets: [**Model No. 186 LL ANO for** 8- and 10-inch] [**Model No. 187 LL ANO for** 12- to 24-inch] deep shelves by Knape and Vogt.
3. Shelf Rests: Model No. 210 ANO End Rest and Model No. 211 ANO Center Rest with Model No. 129 RUB Rubber Cushions.

K. Drawer Slides:

1. Pencil Drawer Slides: Similar to Accuride 2006 having 3/4 extension carburized steel ball bearing, side mounting, 45 pound capacity medium duty load rating, cold rolled steel slide members and ball retainers, bright electro zinc plate finish.
2. Drawers less than 4 inches deep: Similar to Accuride [**7432**] [**3832EC "Easy Close"**] having full extension carburized steel ball bearing, side mounting, 100 pound capacity medium duty load rating, cold rolled steel slide members and ball retainers, cushioned in and outstops, detent-in, progressive action, positive stop, bright electro zinc plate finish.
3. Drawers greater than 4 inches but less than 8 inches deep: Similar to Accuride [**7432**] [**3832EC "Easy Close"**] having full extension carburized steel ball bearing, side mounting, 100 pound capacity medium duty load rating, cold rolled steel slide members and ball retainers, cushioned in and outstops, detent-in, progressive action, positive stop, bright electro zinc plate finish.
4. Drawers greater than 8 inches deep: Similar to Accuride [**4032**] [**3634EC "Easy Close"**] having full extension carburized steel ball bearing, rail mounting, 150 pound capacity heavy duty load rating, cold rolled steel slide members and ball retainers, cushioned in and outstops, detent-in, progressive action, positive stop, bright electro zinc plate finish.
5. Refuse Cabinets: Similar to Accuride 3600-201 having full extension carburized steel ball bearing, bottom mounting, 175 pound capacity heavy duty load rating, cold rolled steel slide members and ball retainers, cushioned in and outstops, progressive action, positive stop, bright electro zinc plate finish.

L. Flipper Door Slides: For vertically mounted retracting cabinet doors up to 75 pounds and 72 inches tall, Model No. 1432, black color, with hinge carrier strip by Accuride, Inc.

M. Silencers: Provide rubber silencers on jamb and/or head and sill strike areas of all cabinet doors and drawers, 2 for paired doors, and 3 for single doors. Silencers shall be approximately 1/4-inch diameter, color compatible with adjacent finish.

N. Aluminum Slides for Sliding Glass Doors: Heavy duty track assembly consisting of upper guide, shoe-H bar, lower track and rollers; clear anodized finish:

1. No. D123A by C. R. Laurence Company, Inc.

O. Door and Drawer Locks: All cabinet doors and drawers shall be furnished with locks. Finish exposed portions of locks to match cabinet pull finish. Furnish 2 keys with each lock and key all locks inside one room alike and provide masterkey for all locks in Project.

1. Drawers: Provide one of the following lock assemblies:

a. Cam lock similar to Hafele 235.10.261, 1-3/16 inch cylinder length, chrome plated, with straight and offset cams; Hafele America, Co., Archdale, NC.
b. Cam lock similar to CompX Type 170 Thick Panel Lock x LP-700 lock plug, satin nickel finish, with surface-mounted strike plate SP-100; CompX Timberline, Neenah, WI.

2. Single Doors: Provide one of the following lock assemblies:

    a. Latch lock similar to Olympus 998/999 Series x 999-Strike, chrome plated, sized to fit opening; Olympus Lock, Inc., Lynnwood, WA.
    b. Deadbolt similar to CompX CB-281 cylinder body x LP-700 lock plug, satin nickel finish, with surface-mounted strike plate SP-100; CompX Timberline, Neenah, WI.

3. Pairs of Doors: Provide the following:

    a. At inactive leaf, Furniture bolt similar to Hafele 252.02.644, polished chrome, with strike 251.60.703; Hafele America, Co.
    b. At active leaf, provide Single Door lock assembly.

P. Grommets for Cable Passage through Countertops: 1-3/4-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Product: Subject to compliance with requirements, provide "[**EDP**] [**MM**] [**LG3**] series" by Doug Mockett and Co., Inc.

Q. Exposed Hardware Finishes: Unless otherwise specified above, or on the Drawings, all exposed portions of the woodwork hardware shall comply with BHMA A156.18 for BHMA finish number indicated.

1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

R. Stainless Steel Trim: Custom fabricate stainless steel trim shapes to the sizes, shapes and profiles shown from the following materials. Provide in standard commercial tempers and hardness, as required for fabrication, strength and durability from Type 304 alloy. Form exposed work true to line and level, with flush surfaces and accurate angles. Ease exposed edges to a radius of approximately 1/32 inch radius, unless otherwise shown. Miter exposed corner joints and machine fit to a hairline joint. All sheet goods shall be provided finished one side only. Finish designation shown on the Drawings are NAAMM nomenclature.

1. Sheet and Plate: ASTM A 666.
2. Bar Stock: ASTM A 276.
3. Pipe: ASTM A 312, Grade TP 304.
4. Tubing: ASTM A 554, Grade MT 304.
5. Rosettes for Capping Brushed Stainless Steel Standoffs at Glass Tops: Custom fabricate rosettes from satin finished stainless steel materials. All fasteners shall be concealed. Fastener for joining rosette assemblies shall be of a type, design, and size as recommended by the glazier for the application shown and specified. Isolate glass from stainless steel using clear plastic cushions sized to fit under the rosettes.

    a. Gyford Standoff Systems.
    b. Forms & Surfaces.

S. Stainless Steel Trim Finish: Provide the following mechanical finish to the exposed surfaces of the fabricated work to the extent indicated (NAAMM nomenclature), with texture and reflectivity as required to match the Architect's sample.

1. No. 4 (bright directional polish).

T. Steel Reinforcing: Carbon steel shapes, tubes and plates complying with ASTM A 36 (shapes and plates), and ASTM A 500 or A 501 (for tubes).

1. Shop Primer for Concealed Steel Reinforcing: Provide fast curing, lead and chromate free, universal modified alkyd primer complying with performance requirements in FS TT-P-664.
2. Electrodes for Concealed Steel Reinforcing: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded.

U. Resilient Base: Refer to Section 09 65 13 "Resilient Wall Base and Accessories."

V. Light Fixtures: Approximately 1-1/4 inch high surface mounted continuous undercabinet LED task light, with adjustable rotation of plus or minus 30 degrees. Task lighting shall have end butted, fixture to fixture, ganging with concealed wiring. Provide each ganged section of light fixtures with a single dimmer switch that, when activated, will switch the entire ganged section of light fixtures to either "on" or "off," and also offers dimming from full capacity to 5 percent capacity.

1. Basis-of-Design Manufacturer and Fixture: Workrite Ergonomics Inc.; Verano Series undercabinet lighting, (800) 959-9675. Other manufacturers will be considered subject to Architect's acceptance.
2. All light fixture components shall be UL Approved and Listed for the applications indicated. Housings shall be constructed of recycled aluminum with water based enamel finish; with transformer to connect to 120 VAC electrical voltage. Provide NEC acceptable wiring, and conduits if required, from light fixtures complete with 3 prong connector for plugging into outlet strips or power receptacles.
3. Lamp Type and Wattage: Each fixture shall include evenly spaced 1W LED lamps with a color temperature of 3500 degrees Kelvin and a CRI of 92; length as required to suit applications shown; other manufacturers will be considered subject to Architect's acceptance.

W. Door Hardware: At full sized doors, provide door hardware as scheduled under Section 08 71 00 "Door Hardware."

X. Hanging (Zee Clip) Strips: Extruded aluminum zee type interlocking clips; type, size and quantity for the condition of use.

Y. Brushed Aluminum Trim Shapes: Custom fabricate aluminum trim shapes to the sizes, shapes and profiles shown from the following materials. Provide in standard commercial tempers and hardness, as required for fabrication, strength and durability. Form exposed work true to line and level, with flush surfaces and accurate angles. Miter exposed corner joints and machine fit to a hairline joint. Finish designations are NAAMM nomenclature.

1. Plate: Alloy 5005 and ASTM B 209.
2. Bar Stock: ASTM B 211.
3. Extrusions: Alloy 6063 and ASTM B 221.
4. Aluminum Trim Finishes: Provide the following finishes to the exposed surfaces of the fabricated work to the extent indicated (NAAMM nomenclature), with texture and reflectivity as required to match the Architect's sample.

    a. Class II, Clear Anodic Finish: Complying with AA-M10M32A31 for an Architectural Class II, medium satin, clear natural anodized finish.

Z. Screws: Select material, type, size, and finish required for each use. Comply with ASME B18.6.1.

AA. Nails, Wire, Brads, and Staples: Select material, type, size, and finish required for each use.

1. ASTM F 1667 for driven fasteners such as nails, spikes and staples.
2. ASTM F 547 for nails used with wood and wood based products.

BB. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.

CC. Blind Splines: Specialty devices, as required for tight butt joining, types and size as recommended by woodwork fabricator.

DD. Covercaps: Where mortises of fastener heads, or draw downs are exposed (blind holes) in finished work, provide black plastic covercaps.

2.4 FABRICATION, GENERAL

A. General: Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to the maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting. The width of scribe and filler panels shall not exceed 1/2 inch, or 1/2 inch clear dimension from adjacent wall to outside face of cabinet door in a 90 degree position, whichever is greater.

1. Interior Woodwork Grade: Premium complying with the referenced quality standard.

B. Fabricate woodwork to dimensions, profiles, and details indicated.

1. Reinforcing shown is minimum. Provide additional steel and lumber reinforcing as required to sustain imposed loads and to ensure a rigid assembly.
2. Exposed surfaces shall be free from dents, tool marks, warpage, buckle, glue and open joints, or other defects affecting serviceability or appearance. Accurately fit all joints, corners and miters. Conceal all fasteners. Make threaded connections up tight so that threads are entirely concealed.

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

1. Seal edges of openings in countertops with a coat of varnish.
2. Install glass to comply with applicable requirements in Section 08 80 00 "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.5 WOOD CABINETS FOR TRANSPARENT FINISH

A. AWS Type of Cabinet Construction: Flush overlay.

B. Wood Veneered Surfaces:

1. Wood Veneered Species and Matching:

a. Wood Veneer Species: As indicated on the Drawings and in the Finish Schedule.
b. Matching:

1) Grain Matching: Run and match grain vertically for drawer fronts, doors, and fixed panels unless otherwise indicated on the Drawings.
2) Matching of Veneer Leaves: Book match unless otherwise indicated.
3) Veneer Matching within Panel Face: Center match unless otherwise indicated.
4) Veneer Matching within Room: Provide cabinet veneers in each room and space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.

C. Semiexposed Surfaces Other Than Drawer Bodies: Compatible species to that indicated for exposed surfaces, stained to match.

1. Drawer Sides and Backs: Solid-hardwood lumber, stained to match species indicated for exposed surfaces.
2. Drawer Bottoms: Hardwood plywood.

D. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

E. Cabinet Locks: Provide door and drawer locks.

2.6 WOOD CABINETS FOR OPAQUE FINISH

A. AWS Type of Cabinet Construction: Flush overlay.

B. Substrate: Medium density fiberboard.

C. Materials for Semiexposed Surfaces Other Than Drawer Bodies: Medium density fiberboard.

1. Drawer Sides and Backs: Solid-hardwood lumber.
2. Drawer Bottoms: Hardwood plywood.

D. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

E. Cabinet Locks: Provide door and drawer locks.

2.7 WOOD CABINETS FOR PLASTIC LAMINATE FINISH

A. AWS Type of Cabinet Construction: Flush overlay.

B. Laminate Cladding for Exposed Surfaces: High-pressure decorative of grade indicated.

1. Horizontal Surfaces Other Than Tops: HGS.
2. Postformed Surfaces: HGP.
3. Vertical Surfaces: VGS.
4. Edges: HGS unless otherwise indicated.
5. Colors, Patterns, and Finishes: As indicated on the Drawings and in the Finish Schedule.

C. Materials for Semiexposed Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.

1. Drawer Sides and Backs: Solid-hardwood lumber.
2. Drawer Bottoms: Hardwood plywood.

D. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

E. Cabinet Locks: Provide door and drawer locks.

2.8 SOLID SURFACING COUNTERTOPS

A. General: Comply with AWS Section 11 and as follows.

B. Solid-Surfacing-Material Thickness: 1/2 inch.

C. Colors, Patterns, and Finishes: As indicated on the Drawings and in the Finish Schedule.

D. Factory fabricate components to achieve required shapes, sizes, and profiles shown, without cracks, spalling, pits, surface porosity, chipped areas, or blisters.

1. Form all tops in one piece lengths. Provide adhesively bonded backsplashes and aprons in heights indicated. Form edges to profiles shown. If required, use 2 sheets of countertop sheet material laminated together using manufacturer's standard adhesive to form edges. Laminated sections shall be in close contact throughout. Adhesive stains will not be permitted.
2. Provide separate 6 inch high end splashes.
3. Countertops shall be factory cored for plumbing fittings provided under Division 22 Plumbing or as indicated on the Drawings.

E. Radius corners and edges. Provide 1/16 inch 1/4 inch radius.

F. Finish exposed surfaces by trimming and grinding smooth.

2.9 FLUSH WOOD PANELING

A. Core Material:

1. Opaque Finished Paneling: Medium density fiberboard.
2. Transparent Finished Paneling: Medium density particleboard or medium density fiberboard.

B. Veneered Surfaces:

1. Veneer Types:

a. Opaque Finished Paneling: Exposed MDF.
b. Transparent Finished Paneling: As indicated on the Drawings and in the Finish Schedule.

2. Transparent Finished Panel Matching:

a. Matching of Adjacent Veneer Leaves: Book matched, unless otherwise indicated.
b. Veneer Matching With Panel Face: Center balance match, unless otherwise indicated.

c. Panel Matching Method: Match panels to one another within each separate area by the following method:

1) Blueprint sequenced matched panels and components.

C. Edge Detail: Edge veneer banded with continuous hardwood strips matching face veneer. Panel joints to be flush type unless otherwise shown.

2.10 WOOD DOOR FRAMES FOR OPAQUE FINISH

A. Frames shall be constructed in accordance with AWS requirements for interior standards, grade as indicated, provided in sizes as shown. In addition, comply with the following:

1. Construct in accordance with AWS Sections 3, 6, and 12.
2. Provide frames in single piece lengths of solid stock hardwood lumber. Form frames with dadoes or rabbeted joints, plant assembled for paint finish.
3. Fabricate subframing from solid lumber stock as hereinbefore specified; fire retardant treated.

2.11 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE AND TRANSPARENT FINISHES

A. General: Complying with AWS Sections 3 and 6, fabricated from solid hardwood with scarfed joints, profiles as indicated, finishes as indicated.

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

C. Wood Species: Poplar for opaque finishes; solid hardwood plank finished with transparent finished wood veneer in veneer cut as indicated on the Drawings to match adjacent transparent finished veneered items.

2.12 CLOSET AND UTILITY SHELVING

A. General: Comply with AWS Section 10 and as follows.

B. Shelf Material: Medium density fiberboard where indicated to be painted; medium density particle board where indicated for plastic laminate or melamine veneer.

C. Cleats: 3/4-inch solid lumber or thermoset decorative panel.

D. Finishes: As shown and scheduled on the Drawings.

2.13 FLUSH WOOD DOORS FOR TRANSPARENT FINISH

A. Construction complying with AWI Woodwork Quality Standards: PC-5 ME particleboard core doors with minimum 1/16 inch thick, properly dried low density hardwood or high density hardboard crossbanding and transparent finished wood face veneers of the specie and cut indicated.

1. Vertical Edges: Same species as face, lumber or veneer, sanded eased edges, without visible joints in lock or hinge edges and free of knife and saw marks.
2. Core: Single thickness slab of particleboard complying with ANSI A208.1, 1-LD-2, hot pressed with synthetic resin glue.
3. Bonding: Stiles and rails bonded to core, then entire unit abrasive planed before veneering. Glue lines between the stiles and rails shall be minimum Type II complying with the performance requirements of WDMA TM-6.
4. Crossbanding materials shall extend full width of door with grain running horizontally, tapeless spliced without voids or show through (telegraphing), and directly glued to core and blocking. Sand crossbanding before application of face veneer. Face veneer shall extend full height of door with grain running vertically, tapeless spliced without voids or show through (telegraphing), and directly glued to crossband. Glue lines between the face veneer, crossbanding and blocking shall be of a type to comply with specified warranty using the hot plate process.

B. Prefitting: Fit wood doors to suit frame opening sizes indicated. Comply with the following:

1. Jamb and Head Clearance: 1/8 inch.
2. Paired Door Openings Meeting Edge: 3/16 inch less than nominal door size for each leaf.
3. Sill Clearance: 1/4 inch from finished floor.

C. Machining: Machine wood doors, paneling and frames, for hardware. Comply with final hardware schedules, shop drawings, and hardware templates.

1. Hardware Location: +/- 1/32 inch.
2. Pulls and Pivots: + 1/32 inch, - 0 inches.

D. Door Thickness: 1-3/4 inch.

2.14 FLUSH WOOD DOORS FOR OPAQUE FINISH

A. Construction complying with AWI Woodwork Quality Standards: PC-5 CE particleboard core doors with minimum 1/16 inch thick, properly dried low density hardwood or high density hardboard crossbanding and medium density overlay (MDO) or high density fiberboard (HDF) face veneers.

1. Vertical Edges: Same as veneer, sanded eased edges, without visible joints in lock or hinge edges and free of knife and saw marks.

2. Core: Single thickness slab of particleboard complying with ANSI A208.1, 1-LD-2, hot pressed with synthetic resin glue.
3. Bonding: Stiles and rails bonded to core, then entire unit abrasive planed before veneering. Glue lines between the stiles and rails shall be minimum Type II complying with the performance requirements of WDMA TM-6.
4. Crossbanding materials shall extend full width of door with grain running horizontally, tapeless spliced without voids or show through (telegraphing), and directly glued to core and blocking. Sand crossbanding before application of face veneer. Face veneer shall extend full height of door with grain running vertically, and directly glued to crossband. Glue lines between the face veneer, crossbanding and blocking shall be of a type to comply with specified warranty using the hot plate process.

B. Prefitting: Fit wood doors to suit frame opening sizes indicated. Comply with the following:

1. Jamb and Head Clearance: 1/8 inch.
2. Paired Door Openings Meeting Edge: 3/16 inch less than nominal door size for each leaf.
3. Sill Clearance: 1/4 inch from finished floor.

C. Machining: Machine wood doors, paneling and frames, for hardware. Comply with final hardware schedules, shop drawings, and hardware templates.

1. Hardware Location: +/- 1/32 inch.
2. Pulls and Pivots: + 1/32 inch, - 0 inches.

D. Door Thickness: 1-3/4 inch.

2.15 SHOP FINISHING

A. Production finish architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

B. Priming of interior architectural woodwork with field applied opaque finish required to be performed at fabrication shop are specified in this Section. Refer to Section 09 91 23 "Interior Painting" for finishing opaque finished architectural woodwork.

C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative overlay.
2. Gluing of face veneers shall, where possible, be by the hot plate method; glued surfaces shall be in close contact throughout. Glue stains will not be permitted.

3. Grain of all transparent finished wood shall run in the direction shown, or if not shown, as accepted on the shop drawings.

D. Exposed Surfaces:

1. Transparent Finish[**(TF##)**]:

a. Grade: Premium.
b. AWS System 5: Conversion Varnish for close grain woods.
c. Staining: Natural to match Architect's sample.
d. Sheen: Match Architect's samples.

2. Opaque Finish[**(OF##)**]:

a. Grade: Custom.
b. AWS System 5: Conversion Varnish.
c. Color and Sheen: Match Architect's paint samples.

3. Plastic Laminate Finish: Gluing of plastic laminate surfacing materials shall be by the hot plate method, glued surfaces shall be in close contact throughout. Glue stains shall not be permitted.
4. Solid Surfacing Finish: As scheduled.

E. Unexposed Wood Finish: Shop-applied alkyd type primer-sealer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas.

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

3.2 INSTALLATION

A. Quality Standard: Install woodwork to comply with requirements of the AWS for the same grade specified in this Section for type of woodwork involved.

1. Install woodwork level, plumb, true, with no distortions, and with no variations in flushness of adjoining surfaces. Shim as required with concealed shims.
2. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

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

C. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.

D. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets without sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.

E. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Calk space between backsplash and wall with silicone sanitary sealant specified in Section 07 92 00 "Joint Sealants."
2. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches on center and to walls with adhesive.

F. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips, by blind nailing on backup strips, splined connection strips, and associated trim and framing. Do not use face fastening, unless otherwise indicated. Space panels so that reveals are parallel and of widths indicated.

G. Built-In Desks and Credenzas: Install without distortion so that doors, and drawers, fit openings properly and are accurately aligned. Adjust hardware to center doors, and drawers, in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.

1. Anchor glass tops securely to supporting framing as indicated on the shop drawings.

H. Doors:

1. Coordinate installation with the work of other trades to ensure exact fit and perfect alignment. Verify dimensions before proceeding and obtain measurements at job site for work required to be accurately fitted to other construction.
2. Do not install wood doors until interior wet work, such as tile, terrazzo, and wallboard work are complete and dried in the areas to receive the wood doors.
3. Do not subject wood doors to abnormal humidity, dryness or heat. Do not expose doors to sudden changes in temperature such as forced heat.
4. Hang wood doors within frames. Align in frames for uniform clearance at each edge matching clearances specified for factory prefitting.
5. Field cutting, fitting or trimming, if required, shall be executed in a workmanlike manner. Cuts made at the job site shall be sealed immediately after cutting, using a clear varnish or sealer. Restore finish before installation, if fitting or machining is required at the job site for factory finished doors.
6. Hardware Installation: Install hardware in accordance with the instructions of the door hardware manufacturer; refer to Section 08 71 00 "Door Hardware."

I. Stainless Steel Cased Openings at Elevator Door Jambs: Install stainless steel cased opening work in locations shown, plumb, level and in alignment with previously completed work. Provide concealed fastening as accepted on the shop drawings, and as necessary for a rigid, secure, and permanent installation. Form tight joints with exposed connections accurately and uniformly fitted together. Do not cut or abrade finishes that cannot be completely restored in the field.

J. Complete the finishing work specified in this Section to extent not completed at shop or before installation of woodwork.

3.3 ADJUSTING AND CLEANING

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

B. Clean woodwork on exposed and semiexposed surfaces. Touchup shop-applied finishes to restore damaged or soiled areas.

1. Anodized aluminum surfaces shall be cleaned with warm water and mild soaps such as those used for hands or dishes. Do NOT use cleaners that contain abrasives, acids or alkalis, as they will mar the surface. Do NOT clean metal face with solvents, paint thinner or adhesive remover. After washing, always wipe the surface completely dry with a soft, clean cloth. Stubborn stains may be removed with a thin, clean oil and dry cloth.
2. Man-made stone top surfaces shall be cleaned with soap and water followed with a clean water rinse.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer, that ensures that woodwork will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 06 40 23

SECTION 07 13 26 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes self-adhering, rubberized-asphalt sheet waterproofing.

1.2 ACTION SUBMITTALS

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

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. Shop Drawings: Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product test reports.

C. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer, approved by manufacturer to install manufacturer's products.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 FIELD CONDITIONS

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

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace waterproofing material that does not comply with requirements or that does not remain watertight for period of ten years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 RUBBERIZED-ASPHALT SHEET WATERPROOFING

A. Rubberized-Asphalt Sheet: 60 mil thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4 mil thick, polyethylene film with release liner on adhesive sideand formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

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

a. Vertical Applications:

1) Carlisle Coatings & Waterproofing Inc.; MiraDRI 860/861.
2) Cetco; Envirosheet.
3) G.C.P. Applied Technologies Inc; Preprufe 160R Plus or Bituthene.
4) Henry Company; Blueskin WP200

b. Horizontal Surfaces Below Slabs

1) G.C.P. Applied Technologies Inc; Preprufe 300R Plus.
2) Approved equal, as reviewed by Owner's Geotechnical Engineer.

2.2 .AUXILIARY MATERIALS

A. Primer: Liquid primer recommended for substrate by manufacturer of sheet waterproofing material.

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

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

D. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

E. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9 inch centers.

F. Protection Course: Semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and nominal thickness1/4 inch.

2.3 MOLDED-SHEET DRAINAGE PANELS

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

B. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side and a polymeric film bonded to the other side of a 3-dimensional, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft..

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

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

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

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

D. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips.

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

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

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

3.2 APPLICATION

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 to dry.

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.

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

E. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic or sealant.

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

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

H. Install protection course with butted joints over waterproofing membrane before starting subsequent construction operations.

3.3 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels according to manufacturer's written instructions. Use adhesives or mechanical fasteners that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.4 PROTECTION AND CLEANING

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

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

C. Horizontal Application: Protect top surface of membrane with protection board from punctures, tears, or burns.

D. Vertical Applications: Protect membrane waterproofing from damage due to uneven substrate.This includes placement of a rigid barrier such as a plywood or rigid insulation between thewaterproofing membrane and the soil backfill material.

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

END OF SECTION 07 13 26

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Mineral-wool blanket.
3. Mineral-wool board.

B. Related Requirements:

1. Section 06 16 00 "Sheathing" for foam-plastic board sheathing installed directly over wood or steel framing.
2. Section 07 13 26 "Self-Adhering Sheet Waterproofing" for insulated drainage panels installed with plaza deck insulation.
3. Section 07 21 60 "Structural Thermal Break System" for reinforced thermoset resin thermal clip system.
4. Section 07 52 16 "Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing" and Section 07 41 13.16 "Standing-Seam Metal Roof Panels" for insulation specified as part of roofing construction.
5. Section 09 29 00 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for the following product types:

    a. Insulation Board.

2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.

1.3 INFORMATIONAL SUBMITTALS

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

B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing protocol required to achieve UL Classified rating. Identify products with appropriate markings of Underwriters Laboratories.

B. Formaldehyde-Free: Third Party Certified with UL Environmental Validation.

C. Recycled Content: A minimum of 50 (or highest available) percent post-consumer recycled glass content, UL-validated.

D. Low-Emitting Materials: For all thermal and acoustical applications of glassinsulation products, provide materials complying with the testing and products requirements of UL Environmental Validation and UL GreenGuard Gold certification.

E. UL Environment Certified: Environmental Product Declaration (EPD).

F. Environmental Product Declarations: For the following product types, obtain products with Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025. Industry-wide EPDs must demonstrate that the manufacturer is a member of the publishing body responsible for the product of the EPD.

1. Insulation boards.

1.5 DELIVERY, STORAGE, AND HANDLING

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

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD (XPS)

A. Manufacturers: Subject to compliance with requirements, product products by one of the following:

1. DiversiFoam Products.
2. Dow Chemical Company (The).
3. Owens Corning.

B. Extruded Polystyrene Board, Type IV, Drainage Panels: ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84; fabricated with shiplap or channel edges and with one side having grooved drainage channels.

2.2 MINERAL-WOOL BLANKETS

A. Manufacturers: Subject to compliance with requirements, product products by one of the following:

1. ROCKWOOL
2. Thermafiber, Inc.; an Owens Corning company.

B. Recycled Content of Insulation: Postconsumer recycled content not less than 50 percent (or highest available).

C. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. ROCKWOOL; Comfortbatt.
2. Owens Corning Thermafiber Ultrabatt.

2.3 MINERAL-WOOL BOARD

A. Manufacturers: Subject to compliance with requirements, product products by one of the following:

1. ROCKWOOL.

2. Thermafiber, Inc.; an Owens Corning company.

B. Recycled Content of Insulation: Postconsumer recycled content not less than 50 percent (or highest available).

C. Mineral-Wool Board, Type III, Unfaced: ASTM C 612, Type III, IVA and IVB; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Nominal density of 8 lb/cu. ft., thermal resistivity of 4.35 deg F x h x sq.ft./Btu x in. at 75 deg F.

1. Rockboard 80.

D. Mineral-Wool Board, Type IVB, Faced: ASTM C 612, Type III; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder; with maximum flame-spread and smoke-developed indexes of zero and zero, respectively, per ASTM E 84. Nominal density of 11 lb/cu. ft..

1. Comfortboard CIS (exterior curtain walls).

2.4 INSULATION FASTENERS

A. Manufacturers: Subject to compliance with requirements, product products by one of the following:

1. AGM Industries, Inc.
2. Gemco.
3. Rodenhouse, Inc.

B. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

C. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

1. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

D. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.

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

    a. Crawl spaces.
    b. Ceiling plenums.

E. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 1 inch between face of insulation and substrate to which anchor is attached.

F. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

G. Insulated sheathing manufacturer's recommended polymer or other corrosion protective coated steel screw fasteners for anchoring sheathing to metal wall framing. Fastener length and size based on wall sheathing thickness.

2.5 ACCESSORIES

A. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

B. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
2. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 04 20 00 "Unit Masonry."

B. Cellular-Glass Board Insulation: Install with closely fitting joints using [**adhesive pad**] [**serrated trowel**] attachment method according to manufacturer's written instructions.

3.6 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
6. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:

    a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

7. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

    a. Exterior Walls: Set units with facing placed toward as indicated on Drawings.
    b. Interior Walls: Set units with facing placed as indicated on Drawings.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.
3. Glass Mineral Wool Blankets: Measured and cut to desired measurements so as to fill gap completely with contact on all sides of surrounding insulation and not compression to finished thickness of material.

C. Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

1. For Glass Mineral Wool (loose fill insulation), comply with NAIMA's "Recommendations for Installation in Residential and other Light Frame Construciton for Fiber Glass Loose Fill Insulation" or manufacturer's written instructions, whichever is more stringent.

D. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.7 INSTALLATION OF CONTINUOUS INSULATION

A. Install insulation in accordance with manufacturer's recommendations. Fasten to exterior face of exterior metal stud wall framing or cmu wall using sheathing manufacturer's recommended type and length screw fasteners with washers. Abut panels tightly together and around openings and penetrations.

3.8 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.

1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
2. Install insulation to fit snugly without bowing.

3.9 PROTECTION

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

END OF SECTION 07 21 00

SECTION 07 41 13.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standing-seam metal roof panels.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

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

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

B. Sustainable Design Submittals:

1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.

C. 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.

D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

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

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

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

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

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

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

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

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.8 DELIVERY, STORAGE, AND HANDLING

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

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

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

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

E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.9 FIELD CONDITIONS

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

1.10 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

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

1.11 WARRANTY

A. Special 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.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

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

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <20> percent.

B. Solar Reflectance Index (SRI): Three-year-aged SRI not less than 64 for low-sloped roof and 32 steep-sloped roof or initial SRI not less than 82 for low-sloped roof and 39 for steep-sloped roof when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

C. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

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

D. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft..

E. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft..

F. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E2140.

G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.

H. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class 1A-135.
2. Hail Resistance: SH.

I. 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.

2.2 STANDING-SEAM METAL ROOF PANELS

A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.
2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1637.

a. Dimensional Metals, Inc.
b. Englert, Inc.
c. Ryerson Tull, Inc.

B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels RF-02: Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Advanced Architectural Products.
    b. Advanced Building Products Inc.
    c. AEP Span; A BlueScope Steel Company.
    d. Architectural Building Components.
    e. Architectural Metal Systems.
    f. ATAS International, Inc.
    g. Berridge Manufacturing Company.
    h. CENTRIA Architectural Systems.
    i. Dimensional Metals, Inc.
    j. Drexel Metals.
    k. Englert, Inc.
    l. Fabral.
    m. Firestone Building Products.
    n. Firestone Metal Products, LLC.
    o. Flexospan Steel Buildings, Inc.
    p. Garland Company, Inc. (The).
    q. IMETCO.
    r. MBCI.
    s. McElroy Metal, Inc.
    t. Merchant and Evans.
    u. Metal Sales Manufacturing Corporation.
    v. Morin - A Kingspan Group Company.
    w. PAC-CLAD; Petersen Aluminum Corporation.
    x. Ryerson Tull, Inc.
    y. Ultra Seam Incorporated.
    z. Union Corrugating Company.

2. Metallic-Coated Steel Sheet: 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. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

    a. Nominal Thickness: 0.022 inch.
    b. Exterior Finish: Two-coat fluoropolymer.
    c. Color: As selected by Architect from manufacturer's full range.

3. Clips: One-piece fixed to accommodate thermal movement.

    a. Material: 0.028-inch- nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.

4. Joint Type: Double folded.
5. Panel Coverage: 12 inches .
6. Panel Height: 2.0 inches.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D1970.
3. Products: Subject to compliance with requirements, provide one of the following:

    a. Carlisle Residential; a division of Carlisle Construction Materials; CCW WIP 300HT.
    b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Grace Ice and Water Shield HT.
    c. Henry Company; Blueskin PE200 HT.
    d. Kirsch Building Products, LLC; Sharkskin Ultra SA.
    e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
    f. Interwrap; Titanium PSU-30..

B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

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 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

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

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

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

D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.

E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.

F. Roof Curbs: Fabricated from same material as roof panels, 0.048-inch nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of 0.060-inch- nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.

1. Insulate roof curb with 1-inch- thick, rigid insulation.

G. Panel Fasteners: Self-tapping screws designed to withstand design loads.

H. 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.

I. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311

J. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following as acceptable to manufacturer:

a. Atlas Roofing Corporation.
b. Carlisle SynTec Incorporated.
c. Dyplast Products.
d. Firestone Building Products.
e. GAF Materials Corporation.
f. Hunter Panels.
g. Insulfoam LLC; a Carlisle company.
h. Johns Manville.
i. Rmax, Inc..

2. Thickness: As indicated on Drawings.

2.5 FABRICATION

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

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

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

D. 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 panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

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

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (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.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

    a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

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

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

3.2 PREPARATION

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

3.3 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the entire roof surface.

B. Felt Underlayment: Apply at locations indicated below, in shingle fashion to shed water, and with lapped joints of not less than 2 inches.

1. Apply over the entire roof surface.

C. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

D. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

3.4 INSTALLATION OF STANDING SEAM METAL ROOF PANELS

A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

2. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
3. Copper Panels: Use copper, stainless steel, or hardware-bronze fasteners.
4. Stainless Steel Panels: Use stainless steel fasteners.

C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
5. Watertight Installation:

    a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
    b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
    c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Clipless Metal Panel Installation: Fasten metal panels to supports with screw fasteners at each lapped joint at location and spacing recommended by manufacturer.

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

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

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

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

I. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

J. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

K. Roof Curbs: Install flashing around bases where they meet metal roof panels.

L. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES

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

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

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

D. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

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

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

END OF SECTION 07 41 13.16

SECTION 07 42 13.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes metal composite material wall panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal composite material panel Installer, metal composite material panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal composite material 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 composite material 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 composite material panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal composite material panel assembly during and after installation.
8. Review procedures for repair of 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. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. Shop Drawings:

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

D. Samples for Initial Selection: For each type of metal composite material panel indicated with factory-applied color finishes.

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

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

1. Metal Composite Material Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal composite material 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 composite material 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.

1.7 DELIVERY, STORAGE, AND HANDLING

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

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

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

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

1.8 FIELD CONDITIONS

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

1.9 COORDINATION

A. Coordinate metal composite material 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 composite material 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.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, the panel framing shall be engineered, fabricated and installed for a deflection of no greater than 1/180 of the span of the framing member. The net deflection of metal wall panels in a direction normal to the plane of the wall when subjected to the maximum inward and outward wind pressures shall not exceed 1/60 of the panel's short length span. Deflection shall be measured relative to horizontal and vertical support members with allowable deflection determined by the lesser dimension.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 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 E 331 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-Resistance Ratings: Comply with ASTM E 119; 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.

F. Fire Propagation Characteristics: Metal composite material wall panel system passes NFPA 285 testing.

2.2 METAL COMPOSITE MATERIAL WALL PANELS MT-01, MT-02

A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, fire retardant core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Alcoa Architectural Products (USA).; Reynobond.
    b. Citadel Architectural Products, Inc.; Envelope 2000.
    c. Firestone Metal Products, LLC; UNA-FAB.
    d. Protean Construction Products, Inc.; ACM 100.

B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- thick, coil-coated aluminum sheet facings.

1. Panel Thickness: 0.197 inch.
2. Core: Fire retardant.
3. Exterior Finish: Two-coat fluoropolymer.

    a. Color: As selected by Architect from manufacturer's full range.

C. Attachment Assembly Components: Formed from extruded aluminum material compatible with panel facing.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material 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 composite material panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material 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 composite material panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

2.4 FABRICATION

A. General: Fabricate and finish metal composite material 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. 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 non-expansion, 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.

2.5 FINISHES

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

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material 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 composite material wall panel manufacturer.

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

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

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal composite material panel manufacturer's written recommendations.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal composite material panels.
2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal composite material panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.

D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.

1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 07 92 00 "Joint Sealants."

2. Dry Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gasket system.
3. Rainscreen Systems: Do not apply sealants to joints unless otherwise indicated.

F. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-returned flanges of wall panels to panel clips with manufacturer's standard fasteners.

1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 07 92 00 "Joint Sealants."
2. Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gaskets.

G. Track-Support Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard horizontal tracks and vertical tracks that provide support and secondary drainage assembly, draining to the exterior at horizontal joints through drain tube. Attach metal composite material wall panels to tracks by interlocking panel edges with manufacturer's standard "T" clips.

1. Attach routed-and-returned flanges of wall panels to perimeter extrusions with manufacturer's standard fasteners.
2. Attach flush wall panels to perimeter extrusions by engaging panel edges and by attaching with manufacturer's standard structural silicone adhesive.
3. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
4. Do not apply sealants to joints unless otherwise indicated.

H. Rainscreen-Principle Installation: Install using manufacturer's standard assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach metal composite material wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.

1. Install wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
2. Do not apply sealants to joints unless otherwise indicated.

I. 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 composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.

J. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that 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 result in 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 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing agency to perform field 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 composite material wall panel installation, including accessories.

D. Metal composite material 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.

3.6 CLEANING AND PROTECTION

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

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

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

END OF SECTION 07 42 13.23

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

A. CONTRACT DOCUMENT

B. All work of this Section shall comply with the requirements of the Main Contract, including General Conditions, Special Conditions, applicable provisions of Division 1 Sections, with the Drawings, and with all other Contract Documents.

1. Should any discrepancy or divergence occur in or between any of the Contract Documents as to the precise extent or nature of the work to be carried out by the Contractor, he/she shall immediately give notice to the Architect and Owner so that an Architect's direction or instruction may be given as to the work in fact required of the Contractor.

1.2 WORK INCLUDED

A. General

1. The Contractor shall design, engineer, test, fabricate, deliver, install, and guarantee all construction necessary to provide for the wall panels for the complete airtight and watertight enclosure of the building. The wall panels shall be complete in every respect, including all measures that may be required to that end, notwithstanding any omissions or inadequacies of Drawings and/or Specifications.

a. Wall panels anchored toexterior sheathing.

1.3 RELATED DOCUMENTS

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

B. Division 1 Section "Quality Control" for independent testing agency procedures and administrative requirements.

1.4 SUMMARY

A. The work of this Section is performance based, and shall be developed, tested and warranted by the Contractor to comply with design intent indicated on the Project Drawings, specified performance criteria and requirements, and relevant statutory and project requirements. In case of any conflict between Drawings and Specifications, including referenced standards and codes, the more stringent or onerous requirement shall apply. Where multiple standards or requirements apply, the more stringent or onerous shall apply.

B. This section includes metal panel cladding and vertical fins integral to the curtain wall and fence/screen wall panels attached to steel framing. The Contractor shall engineer, test, fabricate, deliver, install, and warranty all construction necessary to provide all Curtain Wall and Glazing Assemblies (CWGA) systems including all measures that may be required to that end,
notwithstanding any omissions or inadequacies of the Contract Documents. The work of this Section shall include all materials, components and systems necessary and incidental to the weather-tight installation of the following glass and glazing systems:

C. ELEMENTS OF THE WORK:

1. Wall panelsas described above.
2. All anchors, fixings, miscellaneous steel and attachments to the primary structure and framing reinforcement except those specifically indicated as provided by other trades.
3. All thermal insulation where shown on the drawings.
4. All gaskets, sealants, elastomeric and metal flashing inclusive of sealing at all junctions with ground level waterproofing and building expansion joints and at all interfaces to other new and existing building envelope and wateproofing transitions.
5. Finishes, protective coatings and treatments.
6. Provisions for electrical outlets and cutouts for lighting, conduits, heat tracing cable, and other electrical work.
7. Provisions for plumbing fixtures, including hosebibs, as required.
8. Proposal drawings, data and samples.
9. Design engineering, shop drawings, calculations, engineering data and test reports.
10. Field measurements of adjacent and/or supporting construction and verification of existing conditions where feasible.
11. Scheduling and monitoring of the work.
12. Material samples.
13. On site testing of anchors and field air and water testing.
14. Coordination with the work of other trades.
15. Visual Mock-up including prototype drawings, test procedures, testing and verification of design, components, and total assembly.
16. Storage, handling, protection and cleaning prior to acceptance.
17. Guarantees, warrantees and indemnities.
18. All final exterior and interior cleaning of the Glazing System.

1.5 REFERENCE STANDARDS

A. The Work of this section shall comply with the requirements of the 2014 City of New York Building Code, all referenced standards, and the following additional reference standards. All standards referenced in this Specification shall be those editions, including all amendments current at the date of this Document. Criteria specified herein that exceeds reference standards shall take precedence over such standard.

1. "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" issued by the American Institute of Steel Construction (AISC) and associated "commentary" and issued supplements.
2. "Aluminum Design Manual" and "Aluminum Standards and Data" issued by the Aluminum Association (AA).
3. "The Code for Welding in Building Construction" issued by the American Welding Society (AWS), including but not limited to:

    a. AWS D1.1 Structural Welding Code - Steel.
    b. AWS D1.2 Structural Welding Code - Aluminum.
    c. AWS D1.6 Structural Welding Code - Stainless Steel.

4. The specified active standards of the American Society for Testing and Materials (ASTM).
5. The "Sealant, Waterproofing and Restoration Institute: Sealants: The Professional's Guide" issued by the Sealant and Waterproofing Institute (SWRI).
6. American Society of Civil Engineers (ASCE).

    a. ASCE 7: Minimum Design Loads for Buildings and Other Structures

7. International Code Council (ICC)

    a. International Building Code (IBC)

8. ASTM International (ASTM):

    a. ASTM B 117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
    b. ASTM D 635 - Standard Test Method for Small Scale Burning.
    c. ASTM D 1929 - Standard Test Method for Ignition Temperature.
    d. ASTM D 2244 -

Standard Practice for Calculation of Color Tolerances and Color Differences fro m Instrumentally Measured Color Coordinates.

    e. ASTM D 2247 -

Standard Practice for Testing Water Resistance of Coatings in 100% Relative H umidity.

    f. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
    g. ASTM E 119 - Standard Test Method for Fire Rated or Fire Resistive Construction.
    h. ASTM E 330 -

Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors Under

the Influence of Wind Loads.

9. European Standards (EN): a. EN 438-2
Decorative High Pressure Laminate (HPL) Sheets Based on Thermosetting Resi ns - Determination of Properties.

a. EN 12524 -
Building Materials and Products, Hygrothermal Properties, TabulatedDesign Val ues.

10. International Organization for Standardization (ISO):

a. ISO 105 A02-93 - Tests for Color Fastness -
Part A02: Grey scale for assessing change in color.
b. ISO 178 - Determination of Flexural Properties.
c. ISO 527-3 - Determination of Tensile Properties.
d. ISO 846 - Evaluation of the Action of Organisms.

11. National Fire Protection Association (NFPA):

a. NFPA 268 -
Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Usi ng a Radiant Heat Energy Source.
b. NFPA 285 -
Standard Fire Test Method for Evaluatin of Fire Propagation Characteristics of E xterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

1.6 DRAWINGS AND SPECIFICATIONS

A. Information on Drawings and in Specifications establishes requirements for system's aesthetic effects as well as its performance and prescriptive characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sight lines and relationships to one another and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in-service performance. Prescriptive characteristics are as specified. The drawings are a graphic representation of design intent and do not claim to fully solve movement or structural requirements, pressure equalization, waterproofing, air sealing, thermal requirements, acoustic requirements, glass movement, seismic performance or thermal shock requirements. It is the Contractor's responsibility to provide the final design and solve these requirements. See Section "Delegated Design Submittal".

B. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit details to Architect for review.

C. Should the Contractor adopt the details or arrangements indicated on the Design Drawings it shall be deemed that he has checked the materials, their thicknesses, their buildability and performance in terms of this Specification, all relevant Regulations and codes of practice, and manufacturers' recommendations for any products referred to.

D. Where dimensions are not given, the drawings must not be scaled. The matter is to be referred to the Architect, the Main Contractor, the Façade Consultant and the Client's Representative.

1.7 PERFORMANCE REQUIREMENTS

A. General: Provide wall panels, fins and screens, including anchorage, that will meet or exceed the performance requirements specified herein, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
2. Thermal movements.
3. Movements of supporting structure indicated according to the Movement and Tolerance Report by the Structural Engineer of Record including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
4. Curtain wall and glazed assemblies (CWGA) shall be weather tight and have weather tight interfaces between other exterior wall system assemblies.
5. Dimensional tolerances of building frame and other adjacent construction.
6. Failure includes the following:

    a. Material failures.
    b. Deflection exceeding specified limits.
    c. Thermal stresses transferred to building structure.
    d. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
    e. Noise or vibration created by wind and thermal and structural movements.
    f. Loosening or weakening of fasteners, attachments, and other components.
    g. Sealant failure as described in Section 07 92 00 "Joint Sealants".
    h. Glass failure as described in Section 08 80 10 "Exterior Glass and Glazing".

B. Delegated Design: Design panels, fins, screens and related components, including comprehensive engineering analysis by a qualified professional engineer, currently licensed in the licensing jurisdiction of the project using performance requirements and design criteria indicated. Provide reactions at supports for review by the project engineer.

C. Structural Loads:

1. Systems shall be designed to withstand loads indicated according to ASCE 7 and as required by the applicable Building Code.
2. Design frames and connections of curtain wall and glazed assemblies to accommodate deflections and other building movements.
3. Dead loads: Self weight of construction.
4. Wind Loads for components and cladding: Determined according to the applicable Building Code, ASCE 7.
5. Snow and Ice Loads: Determined according to ASCE 7 per the design data determined by Project's Structural Engineer.

6. Seismic loads: Determined according to ASCE 7 per the design data and loads determined by Project's Structural Engineer.
7. In addition to the minimum design live loads prescribed by the applicable Building Code, glazing systems shall be designed to safely support the following live loads.

    a. Human impact loading in accordance with CPSC Standard 16 CFR 1201, Category II, on those areas of glazing designated as hazardous locations per the applicable Building Code.
    b. These live loading requirements do not need to be superimposed with each other.

8. Other Loads:

    a. Temporary and construction loads:

        1) Design the glazing systems to allow for all handling and installation loads without causing overstress, permanent deflection or warping.
        2) No permanent deformation of panels, channel legs and the like during installation to enable panels to fit into place will be allowed on the project.

D. Deflection of Framing Members: AAMA TIR-A11

1. Deflection Normal to Wall Plane: Limited to L/175 of clear span for spans up to 13 feet 6 inches and to L/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches 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 the lesser of L/360 of clear span or 1/8", or amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension, or which reduces edge clearance between framing members and glazing or other fixed components to run or contact block, or which reduces the minimum edge clearance required to accommodate movements.

    a. In-plane deflections of horizontal members supporting operable components shall be limited to less than 1/16 inch or L/360 whichever is less.
    b. In-plane deflections of corner mullions shall be limited to 1/4 inch in both directions for clear spans up to 16 feet, and to 3/8 inch for clear spans greater than 16 feet.

3. Cantilever Deflection: Where framing members overhang an anchor point, cantilever deflection shall be limited to 2L/175, where L is the length of the cantilever. Deflection of horizontal cantilevered members shall not exceed 3/8".
4. Net deflection parallel and perpendicular to enclosure surface for framing members at perimeter sealant joints shall not exceed smallest of: values specified above, 50 percent of joint width, or movement capacity of sealant.
5. The anticipated movement of the framing members must not exceed the movement capabilities of adjoining sealants.
6. The movement of the framing members must not cause disengagement of applied snap covers or trim.

7. The design of the framing members must accommodate differential movement in adjacent framing members such as might occur at jambs, parapets, unusual geometries and other similar conditions.
8. The framing members must be able to resist any secondary bending moments resulting from axial loads acting through eccentricities caused by large deflections, such as, P-Delta effects.
9. In order to prevent disengagement of the infill material, design of systems incorporating large infill panels must also address the center deflection of the infill panels in conjunction with the framing deflection.

E. Metal Panel Design (Integral to Glazed Curtainwall):

1. Center Deflection of 4 side supported exposed panels shall not exceed L/120, where L is the length of the short edge, or 1/2-inch maximum.
2. Center Deflection of 4 side supported concealed panels shall not exceed L/60 , where L is the length of the short edge, or 1-inch maximum.
3. The deflection of sheet metal shadow boxes and backpans shall be limited to 1/4 inch.

F. Air Infiltration:

1. Provide opaque cladding systems with permanent resistance to air leakage through system of not more than 0.04 cfm/sq.ft. of fixed wall area when tested according to ASTM E283 at a minimum uniform static air pressure differential of 6.24lbf/sq.ft.
2. Requirements:

    a. The facade systems, including all joints between it and other works shall be designed to prevent air flow, from the exterior surface to the interior surface, through the joints of the curtain wall, in the interests of:

        1) Occupier comfort.
        2) Limitation of heat loss.
        3) Reduction of wind noise.

    b. There shall be no regions of concentrated air flow through the external cladding, its closures, or any opening light or smoke ventilator fitted into the external cladding.

G. Water Penetration Resistance:

1. Provide glazing systems that do not evidence water leakage when tested according to the following:

    a. ASTM E 331 at differential pressure of 15 lbf/sq.ft.
    b. AAMA 501.1 under dynamic pressure of 15 lbf/sq.ft.

2. Definition of Uncontrolled Water Penetration and Test Specimen Failure shall be as published by ASTM with the following additions:

a. There shall be no water penetration inboard of the air barrier plane and the assembly shall provide rapid drainage resulting in no retained water in cavities outboard of the air barrier. There shall be no uncontrolled water infiltrating system or migration of water into the concealed spaces of any exterior wall cavity not intended to function as a "wet zone" in the design of the above-grade building envelope. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials and finishes is not considered water leakage.
b. Glazing systems shall be designed, fabricated and installed with the necessary provisions (e.g. continuous built-in gutter system) required to drain accumulated rainwater or condensation inside the system to the building exterior. Provide accessories required to complete the concealed gutter system including but not limited to seals, dams, tubes, sealants and diverters. Provide baffles as required to prevent the ingress of wind driven water as well as insects.

H. Thermal Movements:

1. Provide systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

2. Provide for all thermal movement to take place freely in the plane of the exterior wall system without causing harmful buckling, stress on glass, stone, metal, or joint seals, undue stress on structural elements or glass, excess loads on fasteners, reduction of performance or other detrimental effects.
3. Full movement allowances including assembly and installation tolerances shall be incorporated into all junction/components at each expansion joint or assembly.
4. Where necessary carry out checks in respect of the influence of thermal movement on air permeability and water penetration performances of the installation.
5. The dimensions shown on the drawings are to be based on a design temperature of 72oF. Fabrication, assembly and erection shall therefore take into account the possible thermal movements due to the ambient temperature during fabrication, assembly and installation.

I. Story Drift: Provide EWS systems that accommodate design displacement of adjacent stories according to the Movement and Tolerance Report by the Structural Engineer of Record.

1. Serviceability: When tested in accordance with AAMA 501.4-18 at 1.0x design wind drift, or 1.0x design elastic seismic displacement, whichever is greater:

    a. No visible damage to framing or trim components or assemblies is allowed.
    b. [No glass breakage] or glass fallout is allowed.
    c. Full disengagement of gaskets or weatherseals is not allowed at any location.
    d. Air infiltration and water penetration resistance shall remain within specified allowable limits without adjustment or repair.
    e. No wall components may fall off.

2. Ultimate: When tested in accordance with AAMA 501.4-18 at 1.5x design wind drift, or 1.0x design inelastic seismic displacement, whichever is greater:

    a. Glass shall be retained completely in the glazed opening with no glass fallout.
    b. No wall components may fall off.

J. Self Generated Noise:

1. Design and install glazing systems and all component parts to provide for noiseless movement caused by thermal expansion, and when subject to dynamic load caused by external wind pressure and in the operation of operable components. The system shall not generate noise due to creaking, drumming, or rattle.
2. Metal to metal contact between inter-locking members is not permitted unless specifically indicated on the structural drawings.

K. Fire Performance:

1. General:

    a. Exterior wall systems shall be tested in accordance with, and comply with, the acceptance criteria of NFPA285. Such testing shall be performed on the total wall systems.

2. Surface Burning Characteristics

    a. The Façade/Cladding/Roof Glazing systems shall not be composed of materials which readily support combustion, add significantly to the fire load, and/or give off toxic fumes.
    b. All materials used internally and externally shall have a Class 1 surface burning to ASTM E 84 classification. Façade/Cladding/Roof Glazing system shall have a flame spread index of not more than 25 and a smoke developed index of not more than 450 when tested as an assembly in the maximum thickness intended for use in accordance with ASTM E 84 or UL 723.

3. Fire-Resistance Ratings: Where required comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency

1.8 STRUCTURAL REQUIREMENTS

A. General:

1. Except for anchors embedded in concrete and glass design, allowable stress design (ASD) and load and resistance factor design (LRFD) are acceptable.

a. LRFD shall be used for anchors embedded in concrete.
b. ASD shall be used for glass design.

2. Loads shall be considered in accordance with the load combinations specified by the applicable Building Code.

B. Building Movements:

1. Provide moveable joints to accommodate the full range of movement requirements including manufacturing tolerances, construction tolerances, thermal movement, lateral movement, floor sag, beam sag, live load deflection and column settlement.
2. Allowance for movement shall be in addition to allowance for building construction tolerances.
3. Joints shall accommodate the worst possible combination of erection tolerances and anticipated movements to prevent loads of any kind being transferred from the building into the glazing systems, excessive movements of any joints or failure of weather seals.
4. Design movement joint and select sealant products to accommodate all required expansion and contraction within joint tolerances indicated on the approved shop drawings and within the sealant movement limits recommended by the sealant manufacturer under loaded and unloaded conditions.
5. All movement allowances shall be consistent and applied across all junctions and/or components for each expansion joint system or assembly.
6. Basic preliminary criteria for movements including criteria for envelope of vertical deflections of building structure and span ratios for typical deflections of concrete. These values must be confirmed in writing by the Structural EOR:

    a. Floor slab deflection along perimeter: Refer to Structural Drawings
    b. Maximum horizontal inter-story differential movement (lateral drift): Refer to Structural Drawings
    c. Contractor to confirm that creep assumptions are consistent with the construction schedule.

7. Displacements indicated above are preliminary and provided for reference only. Façade contractor is responsible for confirming design displacements for each slab with the structural engineer of record (EOR), and ensuring the façade system can accommodate them.Joint widths are generally 2 times the width of the allowable movement.
8. The use of shoring, pre-loading, or other methods to limit or control building movements during installation is the responsibility of the Contractor. See section 1.8 Submittals for requirements for submittal of erection procedure and supporting calculation by Contractor.

C. Long Term Building Movements:

1. Design the system to accommodate the absolute relative vertical deflections and horizontal movements that may occur due to panel rotations due to the following displacements occurring between successive floors:

    a. Differential column and core shortening.

b. Beam or slab edge displacement.
c. Axial Shortening of edge beams.
d. Floor to floor drift of the building due to wind and/or earthquake loads.

D. Primary Structure Tolerance:

1. +/- 1 inch in all directions.
2. To be confirmed by Structural Engineer of Record.

1.9 SUBMITTALS

A. Submit the following according to Conditions of the Construction Contract and Division 1 Specification Sections.

1. Submissions shall be complete and comprehensive and include all shop drawings, samples, material data submissions, and engineering calculations for each wall system specified herein, and shall include fully coordinated interface details between each Wall system and the adjacent construction such that air/moisture barrier continuity between the materials, components and systems that comprise the above-grade building envelope can be reasonably evaluated by the Architect-of-Record against the design intent of the contract documents. All work shall be coordinated by the General Contractor prior to submission. Incomplete, non-conforming, or uncoordinated submissions shall be subject to rejection or return without action by the Architect.
2. Analysis: All requirements specified herein shall be analytically and mathematically proven, except for those requirements called for to be proven exclusively by physical testing methods. Calculations and related data and their application in engineering, fabrication, assembly and installation shall be the responsibility of the Contractor's registered Professional Engineer.
3. In addition to the requirements herein, the Trade Contractor shall supply, for Architect's approval, physical samples for the review of the materials' visual appearance. If approved, this material type shall be permitted to be used for the work of this section.

B. Shop Drawings: Show fabrication and installation of glazed aluminum, steel, and panel wall systems including plans, elevations, sections, details of components, and attachments to other units of Work.

C. Product Data: Submit manufacturer's product data for each product specified, including test data, manufacturer's quality assurance documentation, and preparation and installation recommendations. Also include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

D. Samples: Submit samples for verification of each type of exposed finish required in manufacturer's standard U.S. sizes. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. Samples of production materials shall be of the following sizes:

a. Color samples: 12 inches x 12 inches, each color.

E. Delegated Design Submittal:

1. Submit for record to Architect comprehensive design calculations for all members and connections. Design calculations shall be prepared under the supervision of a Professional Engineer currently licensed in the licensing jurisdiction of the project, and shall bear the seal of that Professional Engineer.

F. As-Built Record Shop Drawings and Documents:

1. Submit final approved shop drawings and BIM models in electronic format.
2. Prepare as-built drawings, photographs and other records progressively as the work proceeds.
3. Record Shop Drawings: At the completion of the project, submit electronic copies of all final approved shop drawings prepared under the supervision of and signed and sealed by the Professional Engineer currently licensed in the licensing jurisdiction of the project.

G. Operation and Maintenance Manual: At the completion of the project, submit four (4) bound copies of a maintenance manual describing the various materials, equipment and procedures for cleaning and maintaining the work of this Section. Include the manufacturer's data for all components of each glazing system and type, with supplier/source and contact information included for future reference. Clearly provide replacement procedures, replacement components and methods of replacement of damaged components. Include copies of wall panel systems guarantees and warranties.

H. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB or other hazardous materials as determined by the Owner, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

I. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB), using format in Division 1 Section "Closeout Procedures".

1.10 QUALITY ASSURANCE

A. The work of this section shall be performed by a company which specializes in the type of work and Design Assist process required for this Project, with a minimum of 10 years of documented
successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

1. Work shall be performed in compliance with Owner's insurance underwriters' requirements and UL approvals and testing for materials, assemblies and procedures.

B. Manufacturer shall specialize in manufacturing the type of work specified in this section, with a minimum of 10 years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility and warranty.

C. The Work of this Section shall be the responsibility of one Contractor.

D. The Contractor for the Work of this Section shall have proven achievement and experience in similar work and is subject to approval by the Architect.

E. Manufacturers and suppliers of all materials and components of the Work of this Section are subject to approval by the Architect.

F. All products and individual or aggregate components of the wall assemblies for which acceptable engineering or test data are not available shall be physically tested.

G. Engineering services are defined as those performed for the design and installation of all exterior glazing systems and types specified herein or otherwise included in the contract documents for this project.

1. Engineering Responsibility: Engage a qualified Professional Engineer currently licensed in the licensing jurisdiction of the project to prepare, or supervise the preparation of, drawings, calculations, and data for the Work of this Section to include a comprehensive engineering analysis that demonstrates full compliance requirements of the contract documents.
2. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility.

H. Source Limitations: Obtain each type of wall system from one source, and by a single manufacturer.

I. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." Meeting shall include Contractor, Owner, Architect, curtain wall installer, sealant installer, as well as any other subcontractors or material technical service representatives whose work, or products, must be coordinated with the curtain wall work. Review methods and procedures related to glazed aluminum exterior wall system including, but not limited to, the following:

1. Review and discuss condition of substrate and other preparatory work performed by other trades.
2. Review erection procedure prepared by Contractor and discuss coordination of procedure with previously installed scope of work.
3. Review structural loading limitations.
4. Review and discuss the sequence of work required to construct a watertight and weather tight exterior building envelope.
5. Review and finalize construction schedule and verify availability of materials, Contractor's personnel, equipment, and facilities needed to make progress and avoid delays.

6. Review required inspecting, testing, and certifying procedures and coordinate with installation schedule and work of individual trades to avoid delays in the Work.
7. Review weather and forecasted weather conditions, and procedures established to mitigate the impact of unfavorable weather conditions on the quality and progress of the Work.

J. Prior to the start of fabrication, the Contractor shall submit a comprehensive Quality Assurance Program covering all phases of the exterior wall system including, but not necessarily limited to, the following:

1. Procurement of materials including quality control programs of major suppliers.
2. Verification of compliance with International Standards Organization (ISO) or similar agency authorized or otherwise qualified and accredited to provide periodic, independent review and certification of each supplier/manufacturer's Quality Assurance program.
3. Fabrication of components, to include milestone inspections and written certification that components and finishes meet or exceed the requirements of the contract documents and recognized industry standards specified herein, and that pre-finished components and parts are free of any visible scratches, gouges, dents, blemishes and similar damage considered by the Architect to be unacceptable for the project.
4. Final assembly of components, to include milestone inspections and written certification that internal end-dams, zone-dams and critical seals have been installed in accordance with the contract documents and recognized industry standards specified herein.
5. Installation and site quality control, to include a sample of the intended Field Report format and intended method to track or otherwise monitor and correct all non-conforming work in a manner that is consistent with the requirements of the contract documents, and available on site for review and independent verification by the Architect and Owner.
6. Periodic, in-house evaluation and performance testing of completed systems and assemblies to verify compliance of glazing systems and assemblies during production, prior to shipment to project site.
7. The QC Programs submitted by each of the sub-contractors, suppliers, manufacturers shall be included by the GC/CM into a comprehensive and fully integrated, project-specific Building Envelope Quality Assurance Program.
8. The submittal shall include the identification of a single, qualified Quality Assurance Manager representing the GC/CM who will be in responsible charge of developing and administering the Building Envelope Quality Assurance Program (BEQAP) throughout the duration of the project.
9. The BEQAP shall be subject to review and approval by the Architect, Owner, and Owner's building envelope technical representative.
10. The Architect and Owner shall be allowed access to the Contractor's facilities and those of the major suppliers and sub-contractors to monitor QC procedures. The Contractor shall make available to the Owner and the Architect all QC Program records upon request.

1.11 VISUAL MOCK-UPS

Full scale visual mock-ups to confirm finish selection of wall panels, principal materials, dimensions, tolerances, etc., of the following wall types shall be provided

Prior to the start of fabrication of job material provide a Visual Mock-up of the typical systems as shown in

the design drawings, complete in all respects including glass, framing, supports, metal cladding, shading devices and operable panels.
Extent and scope of visual mock-up are as indicated in the Architectural Drawings.
Visual Mock-up shall be erected at the job site as directed by the Architect.
Mock-ups shall include representations of framing, shading elements and interior finishes, as described in the Architectural Drawings.
Provide full sized panel samples for all exterior types. Samples shall be reviewed at the panel fabrication facility.
Placement and orientation of the mock-up shall be such that it may be viewed from both the interior and the exterior, at various distances and angles, and under natural daylight and artificial lighting conditions.
Demonstrate the proposed range of aesthetic effects regarding each element prescribed herein.
Mockup will have finished surface including surface preparation and paint system.
Approval of the mockup shall be by the Owner and the Architect. Remediate and revise as required to obtain the acceptance of the Owner and the Architect.
Retain and maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.

1.12 DELIVERY, STORAGE AND HANDLING

A. Comply with General Conditions and Division 1 Section "Product Requirements".

B. Deliver panel systems and components complete with factory applied protections, removable labeling, and packaging to comply with manufacturer/fabricator's requirements and adequately protected from damage during shipment.

C. Protect panel systems and components from adverse job conditions before, during and after installation, including but not limited to:

1. Condensation, temperature changes, direct exposure to sun, or other causes that could otherwise damage the assemblies
2. The work of other trades before, during, and after installation (e.g. weld slag, run-down staining/etching of aluminum and glass surfaces and similar).

D. Storage:

1. Coordinate storage requirements and logistics with the General Contractor before shipping materials.
2. Components shall be stored on elevated platforms, skids or pallets; covered with tarpaulins or other suitable weather-tight covering. Covering material shall allow for air circulation about the components. Store panel components so that water accumulation drains freely.
3. Neatly stack (in a manner that will not affect the components) system assemblies in locations designated by the Contractor. Isolate panel assemblies at all contact points; store assemblies to prevent permanent damage, deformation and similar distress.
4. Do not store system materials in contact with other materials that might cause scratching, gouging, staining, etching of aluminum and glass surfaces, denting, surface damage, or other deleterious effect.

E. Handling:

1. Take into account the restrictions imposed on the delivery of pre-fabricated elements by the existing building's dimensions and site access.
2. Care shall be exercised to properly brace and reinforce prefabricated assemblies against racking during hoisting and installation.

1.13 GUARANTEES AND WARRANTIES

A. Comply with General Conditions and Division 1 Section "Product Requirements". The more stringent requirements of the contract documents shall apply.

B. Guarantee/Warrantee Period:

1. Provide a warranty for materials and workmanship of the Glazed Curtain Wall Contract from Date of Completion for a period of ten (10) years (the "warranty period"). Provide all manufacturer's pass through warranties. Also provide a warranty to cover all the costs of materials, labor and equipment to remove any defective components of the glazing systems and replace them.

C. Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of a glazed exterior envelope system that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including, but not limited to, excessive deflection.
2. Noise or vibration caused by design loads, thermal or other movements.
3. Thermal stresses transferring to building structure.
4. Failure of system to meet performance requirements.
5. Failure of operating components to function normally.
6. Loosening or weakening of fasteners, attachments, hardware and other components.
7. Deterioration, fading, excessive non-uniformity, pitting, cracking, peeling, crazing or discoloration of finishes and other materials beyond normal weathering.
8. Adhesive or cohesive sealant failures or crazing on surface of sealant.
9. Gaskets or weather strips hardening, discoloration or disengagement.

D. Owner's Rights:

1. The Guarantees submitted under this section shall not deprive the Owner of other rights or remedies that the Owner may have under other provisions of the Contract Documents and is in addition to and runs concurrent with other guarantees made by the Contractor under requirements of the Contract Documents.
2. Inspections Upon and After Substantial Completion: Owner's Inspecting Agent (Agent) shall inspect entire system at six months and twelve months after the date of Substantial Completion and provide a written report to the Contractor and Architect. Systems will be evaluated during actual wind-driven rain events at the discretion of the Agent. Contractor shall promptly replace defective work.

PART 2 - PRODUCTS

2.1 MATERIALS

2.2 UNAUTHROIZED MATERIALS

A. Materials and products required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the Owner.

2.3 SUBSTITUTIONS

A. Requests for any departure from Contract Documents must be submitted in writing by the Contractor and accepted in writing by the Design Professionals, prior to receipt of submittals.

B. All substitutions must be requested using the form in Division 1 Section "Substitution Request Form" in accordance with General Conditions and Division 1 Section "Product Requirements". Acceptance using the substitution request form indicates acceptability of the structural concept only. Contractor must submit shop drawings reflecting accepted substitutions for review in accordance with this Specification. The structural substitution request form, even if accepted, does not constitute a change order.

C. All substitution requests must be submitted with all necessary documentation to show compliance with the performance specifications herein.

D. Such substitutions or modifications, if acceptable to the Design Professionals shall be coordinated and incorporated in the work at the sole expense of the Contractor.

E. The acceptance by the Design Professionals of a specific and isolated request by the contractor to deviate from these requirements does not constitute a waiving of that requirement for other elements of, or locations in the project, unless specifically addressed as such and permitted by the Design Professionals in writing.

F. Compensation for Additional Services: Should additional work by Design Professionals such as design, documentation, meetings and/or site visits be required which are necessitated for the review and/or incorporation of the Contractor-requested substitution, including indirect effects on other portions of the work, the Contractor is responsible for paying for additional work performed by the Design Professionals at the standard billing rates plus out-of-pocket expenses incurred at cost. Additional costs for testing and inspection by the Owner shall also be compensated by the Contractor.

G. Contractor is responsible for means and methods and any impacts on other portions of the work that may arise from this substitution.

2.1 SOLID PHENOLIC WALL PANELS, FINS AND SCREENS

A. Basis of Design:

1. Trespa Meteon by Trespa International as represented by Trespa North America, LTD.
2. Approved Equal.

B. Material: Solid panel manufactured using a combination of high pressure and temperature to cre ate a flat panel created from thermosetting resins, homogenously reinforced with wood-based fibers and an integrated decorative surface or printed décor.

C. Color: As selected by the Architect. Refer to Material Index on the Architectural Drawings.

D. Finish: As selected by the Architect. Refer to Material Index on the Architectural Drawings.

E. Panel Core: Fire retardant (FR) core.

F. Panel Thickness: ½" minimum.

G. Physical Properties:

1. Modulus of Elasticity: 1,300,000 psi (9000 N/mm2) minimum, ISO 178.
2. Tensile Strength: 10,100 psi (70 N/mm2) minimum, ISO 527-2.
3. Flexural Strength: 14,500psi (120 N/mm2) minimum, ISO 178.
4. Thermal Conductivity: 2.1 BTU/inch/ft2.hr.°F, EN 12524.
5. Structural Performance (ASTM E330):

    a. Panels shall be designed to withstand the Design Wind Load based upon the local building code.
    b. Deflections:

        1) Normal to the plane of the wall, the maximum panel deflection shall not ex ceed L/175.
        2) Normal to the plane of the wall between supports, deflection of the aluminu m sub-

framing members shall not exceed L/175 or 3/4 inch, whichever is less.

H. Fire Performance:

1. Flame Spread: Class A, ASTM E 84.
2. Smoke Development: Less than 450, ASTM E 84.
3. Ignition Temperature: Greater than 650 degree F above ambient, ASTM D 1929.
4. Burning Classification: CC1 or CC2, ASTM D635.
5. When required for compliance with local building

codes, the wall cladding assembly shall show no degradation of the rating of Fire Resistant Assemblies, ASTM E119.

6. When required for compliance with local building codes, the wall cladding assembly includi ng cladding and non-

cladding elements such as, but not limited to, specific weather resistive barriers and/or exte rior insulation materials, shall meet the

performance requirements of NFPA 285. Performance shall be determined by actua testing in accordance with NFPA 285 or through an equivalency analysis provided by a rec ognized fire protection expert.

7. When required for compliance with local building codes, the wall cladding assembly shall n ot ignite when exposed to a radiant heat energy source, NFPA 268.

I. Finish Performance: Electron Beam Cure resin in conformance with the following general requir ements:

1. Color: As selected by the architect/engineer from manufacturer's standard colors or a custo m color to be matched by the panel supplier.
2. Humidity Resistance: No formation of blisters when subje
ted to condensing water fog at 100% relative humidity and 100 degree F (38 degree C) for 3000 hours, ASTM D 2247.
3. Salt Spray Resistance: Corrosion creepage from
scribe line (1/16 inch (1.6 mm) max.) and minimum blister rating of 8 within the test specim en field, ASTM B117.
4. Weather Exposure: Accelerated -
3000 hours in Atlas Type Weatherometer using cycle of 90 minutes light and 30 minutes di minished light and demineralized water with a maximum color change of 5 Delta E units fro m the original color according to ASTM D-2244, with the exception of Uni-
Colors A12.3.7 / A18.3.5 / A04.1.7, which will not deviate more than 10 Delta E units from original color according ASTM D-2244.
5. Color Stability: The decorative surface comply with, classification, 4 - 5 measured with the grey scale according to ISO 105 A02-
93 according to test method EN 438-2:29.
6. Microbial Characteristics: Will not support micro-organic growth (ISO 846).

J. Mounting system: Concealed fastening. Fins and perforated cladding must be integrated into the stick built curtain wall with thermally broken brackets. Screens must be anchored to steel framing. The systems must comply with NFPA 285 requirements.

K. Fasteners (Concealed): Fasteners shall be non-
corrosive and as recommended by panel manufacturer. Exposed fasteners shall be colored to match panels where required by the architect.

2.2 BRACKETS AND ANCHORS

A. General:

1. Anchors and connections that are engineered for movement shall include suitable low friction materials specified in this section, as or recommend by the manufacturer.
2. All components are to be designed for the maximum tolerance of the system relative to the base structure, including but not limited to those referenced in Section "Building Movements", and due consideration shall be given to additional forces from prying action and bolt group effects.
3. Connections between different materials, or different alloys of the same metal, shall be engineered to accommodate the differential thermal movement of the materials to be connected.
4. Design fixing brackets for the worst possible panel eccentricity, packing location, and uneven load sharing. Include prying effects on bolt groups.
5. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.

6. Do not use explosive shot fired devices unless approved in writing before commencing installation.

2.3 SEALANTS (WEATHERSEAL)

A. Comply with Section 07 92 00 "Joint Sealants".

B. All joints, which are sealed with sealant as part of the fabrication or erection procedure, shall be sealed with silicone (exposed or concealed) sealant in color to match the adjoining surfaces or as required by the Architect. All perimeter sealant (metal to adjacent construction) shall be low or medium modulus silicone sealant. Silicone sealant shall be as manufactured by Dow Corning or GE.

C. Seals to air barrier and membrane wall materials shall be Dow Corning 758 medium modulus silicone complying with ASTM C920 as recommended by the sealant and air barrier manufacturer. The sealant shall be designed for adhering to low energy surfaces common in sheet or peel and stick weather resistant barriers. Compatibility and adhesion of sealants with air barrier materials shall be demonstrated by the sealant and membrane manufacturers, based on testing and shall be submitted in writing. Test procedure shall be as indicated below and as specified herein.

1. Adhesion: ASTM C794 Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
2. Compatibility: ASTM C1087 Standard Test Method for Determining Compatibility of Liquid- Applied Sealants with Accessories Used in Structural Glazing Systems.

D. Sealants shall have a VOC content of 250 g/L or less.

E. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evalulation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Care shall be exercised to insure against "Three Surface Adhesion". Bond breakers shall be provided.

1. Comply with ASTM C 1193 Standard Guide for Use of Joint Sealants.

G. Provide two lines of weather seal:

1. Primary seal shall be both an air and water seal.
2. Secondary seal shall be water seal.

H. Provide non-staining sealant when sealing to porous substrates such as natural stone, wood, or concrete.

2.4 FABRICATION AND ASSEMBLY

A. General:

1. All work shall be of the highest quality, in accordance with the best trade practices, and performed by skilled workmen. All work shall be accomplished to the satisfaction of the Architect and Owner.
2. To the fullest extent practicable, fabrication and assembly shall be executed in the shop. All Work that is not shop-assembled shall be shop-fitted.

B. Solid phenolic impregnated kraft paper wall panels with no voids, air spaces or foamed insulatio n in the core material.

C. Accessory items in accordance with manufacturer's recommendations and approved submittals

D. Panel Weight: 8 mm (2.4 lb/ft2), 10 mm (3 lb/ ft2), 13 mm (3.8 lb/ ft2).

E. Panel Bow: = 2 mm / m (= 0.079 inch/39.38 inches).

F. Panel Dimensions: Field fabrication shall be allowed where necessary, but shall be kept to an a bsolute minimum. All fabrication shall be done under controlled shop conditions when possible.

G. Appearance: Panel lines, breaks, and angles shall be sharp, true, and surfaces free from warp a nd buckle.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to start of installation, inspect the building and verify as-built conditions and dimensions as being acceptable to receive the Work of this Section. Verify elevations of concrete and structural steel framing, and location of embeds and other anchorages for compliance with the Work of this Section.

B. Should any conditions be found that may prohibit proper execution of the Work, the Contractor shall immediately notify the Architect in writing of these conditions. Installation shall not proceed until a recommended course of remedial action has been submitted and approved in writing by the Architect, prior to execution in the field.

C. Provide a complete site survey of existing conditions to ensure the accuracy of layout and dimensional information.

D. Joint widths as noted in the Contract Documents are the design joint width at the ambient temperature of 75°F. Installation procedures should be adjusted to take into account the ambient temperature at the time of installation.

3.2 PREPARATION

A. Provide connections for temporary shoring, bracing and supports only where noted on the approved shop drawings. Temporary connections not shown shall be made at locations not exposed to view in the final structure or as approved by the Architect. Handle, lift and align pieces using padded slings and/or other protection required to maintain the appearance of the glazing systems through the process of erection.

3.3 INSTALLATION

A. Install solid phenolic wall panels and sub-
frame system in accordance with manufacturer's instructions.

B. Install solid phenolic wall panels plumb and level and accurately spaced in accordance with ma nufacturer's recommendations and approved submittals and drawings.

C. Anchor panels and sub-
framing securely per engineering recommendations and in accordance with approved shop dra wings to allow for necessary movement and structural support.

D. Fasten solid phenolic wall panels with fasteners approved for use with supporting substrate.

E. Do not install panels or component parts which are observed to be defective or damaged includi ng, but not limited to: warped, bowed, abraded, scratched, and broken members.

F. Do not cut or trim component parts during installation in a manner that would damage the finish, decrease the strength, or result in visual imperfection or a failure in performance. Return compo nent parts with require alteration to the shop for re-fabrication or replacement.

G. Install corner profiles and trim with fasteners appropriate for use with adjoining construction as i ndicated on the Contract Drawings and as recommended by manufacturer.

3.4 EMBEDS, ANCHORS AND CONNECTIONS:

A. Supply anchorage items to be embedded in or attached to other construction. Provide embed layouts, setting diagrams, templates, instructions and directions as required for installation.

B. After system components are positioned, fix connections to building structure as indicated on approved Shop Drawings. Provide separators and isolators to prevent metal corrosion and electrolytic deterioration.

C. Connections between different materials shall be designed to allow for the differential thermal movement of the respected materials.

D. Avoid excess shimming that may induce additional stress on the fastener. The total thickness (t) of a shim pack shall not exceed a dimension equal to the diameter (d) of the fastener/anchor. Where t>d, the fastener/anchor shall be recalculated to take into account the additional stress from bending on the fastener with the assumption that the shim does not contribute to resistance to fastener bending. Additional stress due to bending shall be added to tension stress and the tension/shear interaction analyzed.

E. Anchorages to Structural Steel shall not induce rotational forces in supporting members.

F. Shim packs that resist compressive forces only may be high-impact plastic, Korolath type, or equal. Shim packs subject to shear shall be stainless steel or HFG steel plates pinned together to form a monolithic shim.

3.5 CLEANING AND PROTECTION

A. Remove masking or panel protection as soon as possible after installation. Any masking intentio nally left in place after panel installation on an elevation, shall become the responsibility of the G eneral Contractor to remove.

B. Adjust final panel installation so that all joints are true and even throughout the installation. Pan els out of plane shall be adjusted with the surrounding panels to minimize any imperfection.

C. Repair panels with minor damage. Remove and replace panels damaged beyond repair as a dir ect result of the panel installation. After installation, panel repair and replacement shall become the responsibility of the General Contractor.

D. Clean finished surfaces as recommended by panel manufacturer. After installation cleaning, cle aning during construction shall become the responsibility of the General Contractor.

3.6 PROJECT CLOSE-OUT

A. Repair and Replacement: Repair or remove and replace work that does not conform to specified requirements. Repairs made in one area shall be incorporated into all other similar areas as applicable.

B. Site Modifications: Finished work that contains unauthorized site modifications, or work not in accordance with the approved shop drawings, or submittals specified herein, may require additional modification in the field, or removal and replacement at no additional cost to the Owner. Any additional calculations and testing required for approval by the Architect shall also be provided at no additional cost to the owner.

Acceptance of the completed installation of the exterior wall system requires that the installation be

structurally sound, weather tight, and free from defects of materials and workmanship.

SECTION 07 44 74 – POLYMER-MODIFIED CEMENT FACED PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulating drainage panels.
2. Concrete faced insulated sheathing.
3. Concrete faced insulated perimeter wall panels.

B. Related Requirements:

1. Division 01 - General Requirements: Administrative, procedural, and temporary work requirements.

2. Section 07 24 19 "Water-Drainage Exterior Insulation and Finish System (EIFS)" for EIFS-clad drainage-wall assemblies.

3. Section 07 26 00 "Vapor Retarders" for wall sheet vapor retarders.

4. Section 07 27 13 "Modified Bituminous Sheet Air Barriers" for self-adhering sheet air barriers composed of bituminous materials applied over sheathing behind mechanically fastened EIFS.

5. Section 07 27 15 "Nonbituminous Self-Adhering Sheet Air Barriers" for self-adhering sheet air barriers composed of nonbituminous polymers applied over sheathing behind mechanically fastened EIFS.

6. Section 07 27 26 "Fluid-Applied Membrane Air Barriers" for fluid-applied, synthetic polymer air barriers applied over sheathing behind EIFS-clad wall assemblies.

1.2 REFERENCES

A. ASTM International (ASTM):

1. C518 - Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
2. C947 - Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam With Third-Point Loading).
3. C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
4. D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between 30 176C and 30 176C With a Vitreous Silica Dilatometer.

5. D1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
6. D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
7. D2394 - Standard Test Methods for Simulated Service Testing of Wood and Wood Base Finish Flooring.
8. D4716 - Standard Test Method for Determining the (In plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
9. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
10. E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:

1. Convene at Project site 2 weeks prior to beginning work of this Section.
2. Attendance: Architect, Contractor, Construction Manager, installer, and related trades.
3. Review: Project conditions, manufacturer requirements, delivery and storage, staging and sequencing, and protection of completed work.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.

B. Samples:

1. Color chips representing manufacturer's full range of available colors and patterns.
2. After color selection submit [4 x 4] [__ x __[inch samples of each color and patterns.

C. Samples: For each exposed product and for each color and texture specified, 8 inches square in size.

D. Samples for Verification: 24-inch- square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work, including custom trim, each profile, and an aesthetic reveal.

1. Include exposed trim and accessory Samples to verify color selected.

2. Include a typical control joint filled with sealant of color selected, as specified in Section 07 92 00 "Joint Sealants."

E. Shop Drawings: For prefabricated EIFS panels.

1. Include plans, elevations, sections, details of components including build-outs, details of penetrations and terminations, flashing details, joint locations and configurations, lifting points, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.

F. Panel Schedule: For prefabricated panel fabrication.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer fabricator/erector.

B. Manufacturer Certificates: Signed by Cement Faced Panel manufacturer, certifying the following:

1. Cement Faced Panel substrate is acceptable to Cement Faced Panel manufacturer.

2. Accessory products installed with Cement Faced Panel, including joint sealants, flashing, trim, whether or not furnished by Cement Faced Panel manufacturer and whether or not specified in this Section, are acceptable to Cement Faced Panel manufacturer.

C. Product Certificates: For cementitious materials and aggregates and for insulation, from manufacturer.

D. Product Test Reports: For each Cement Faced Panel assembly and component, for tests performed by a qualified testing agency.

E. Field quality-control reports.

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

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For Cement Faced Panel to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Minimum [__] years experience in work of this Section.

B. Manufacturer: Provides design, engineering, fabrication, and testing of required components and assemblies for complete system.

C. Mockup: Provide mockup for evaluation of surface preparation techniques and application workmanship.

1.8 DELIVERY, STORAGE, AND HANDLING

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

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

1. Stack insulation board flat and off the ground.

2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.

3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.9 SITE CONDITIONS

A. Substrate and ambient air temperature in accordance with manufacturer's requirements.

B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit cement faced panels to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

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

1.10 WARRANTY

A. Manufacturer’s standard year warranty against defects in materials and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Contract Documents are based on products by T. Clear Corporation, 800-544-7398, email sconfer@tclear.com, www.tclear.com.

B. Substitutions: [Refer to Division 01.] [Not permitted.]

2.2 MATERIALS

A. Insulating Drainage Panels:

1. Source: Thermadry Insulating Drainage Panels by T. Clear Corporation.
2. Performance: Type 750; 25 PSI,

    a. Thickness: 2 inches.
    b. R-value: 9.4, tested to ASTM C518.
    c. Compressive strength: 2160 PSF, tested to ASTM D1621.
    d. Flow rate: 9.5 gallons per minute per foot at 500 PSF.

3. Performance: Type 1250; 40 PSI:

    a. Thickness: 2 inches.
    b. R-value 9.4, tested to ASTM C518.
    c. Compressive strength: 3460 PSF, tested to ASTM D1621.
    d. Flow rate: 12 gallons per minute per foot at 500 PSF.

4. Performance: Type 1750; 60 PSI:

    a. Thickness: 2 inches.
    b. R-value 9.4, tested to ASTM C518.
    c. Compressive strength: 5180 PSF, tested to ASTM D1621.
    d. Flow rate: 12 gallons per minute per foot at 500 PSF.

5. Construction:

    a. Composite of insulation and fabric.
    b. Closely-spaced vertical and horizontal channels on one side of panel.
    c. Filtration fabric overlaps adjacent panels both vertically and horizontally.

6. Size: 2 x 8 feet.
7. Edges: Square.

B. Concrete Faced Insulated Sheathing:

1. Source: ProGUARD Insulated Sheathing Panels by T. Clear Corporation.
2. Description: Concrete faced exterior insulation consisting of 1/4 inch thick cement backerboard laminated to extruded or 2 expanded polystyrene.
3. Concrete face:

    a. Compressive strength Minimum 2600 PSI, tested to ASTM D2394.
    b. Flexural strength: Minimum 1500 PSI, tested to ASTM C947.
    c. Linear variations with change in moisture to air dry: Width 0.02 percent, length 0.02 percent, tested to ASTM D1037 at 50 percent relative humidity and 73 degree F.
    d. Surface burning characteristics: Flame spread/smoke developed rating 0/0, tested to ASTM E84.
    e. Weigh per square foot: 1.95 pounds.
    f. Fastener pull through:: Minimum 195 pounds.
    g. K-factor: 1.6.
    h. R-factor: 0.16.

4. Extruded polystyrene:

    a. Type: ASTM C578, Type X.
    b. Density: 1.3 PCF.
    c. Compressive Strength: 25 PSI.
    d. R-value per inch at 75 degrees F: 5.0.
    e. Water absorption: Maximum 0.30 percent by volume.
    f. Water vapor permeance: 0.733 for 1-1/2 inch thickness; 0.55 for 2 inch thickness.
    g. Surface burning characteristics: Maximum flame spread/smoke developed rating 5/165, tested to ASTM E84.

5. Expanded polystyrene:

    a. Type: ASTM C578, Type IX.
    b. Density: 2.0 PCF.
    c. Compressive Strength: 25 PSI.
    d. R-value per inch at 75 degrees F: 4.35 to 5.0.
    e. Water absorption: Maximum 2 percent by volume.
    f. Water vapor permeance: Maximum 2.5.
    g. Surface burning characteristics at 4 inch thickness: Maximum flame spread/smoke developed rating 5/100, tested to ASTM E84.

6. Overall panel thickness: 2-1/4 inches.

C. Concrete Faced Insulated Perimeter Wall Panels:

1. Source: WallGUARD Concrete Faced Insulated Perimeter Wall Panels by T. Clear Corporation.

2. Construction:

    a. Extruded polystyrene board, ASTM C578, Type IV, rigid, closed cell, with integral high density skin, with integral 5/16 inch thick latex-modified concrete facing.
    b. Board Size: 2 x 4 feet x 2-5/16 inches thick.
    c. Edges: Tongue-and-groove sides, square ends.
    d. thermal resistance: Long term aged R-value of 5 per inch, tested to ASTM C518.
    e. Foam compressive strength: Minimum 35 PSI, tested to ASTM D1621.
    f. Compressive strength: Minimum 40 PSI, tested to ASTM D 1621.
    g. Water absorption: Maximum 0.7 percent by volume, tested ASTM D2842.
    h. Water vapor permeance: 0.8, tested to ASTM E96/E96M.
    i. Coefficient of lineal thermal Expansion: 3.5 x 10-5 inches per inch x degree F, tested to ASTM D696.

3. Accessories:

    a. Metal cap flashing: 24 gage galvanized steel J-channel; 2-1/4 inches wide, 4 inch long leg and 2-1/4 inch short leg; prefinished, color to be selected.
    b. PVC cap flashing: Ultraviolet stabilized PVC, 0.060 inch thick, Z-shaped, with drip edge, gray.
    c. Clips and fasteners: Corrosion-resistant, sized to suit application; as supplied by insulation manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where cement faced panels will be installed.

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

1. Application of panels indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of cement faced panels.

B. Protect cement faced panels, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind cement faced panels and deterioration of substrates.

C. Prepare and clean substrates to comply with cement faced panel manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

1. Concrete Substrates: Provide clean, dry, neutral-pH substrate for insulation installation. Verify suitability of substrate by performing bond and moisture tests recommended by cement faced panel manufacturer.

3.3 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

3.4 INSTALLATION OF INSULATING DRAINAGE PANEL

A. Foundation Wall Insulation:

1. Surfaces to receive panels:

a. Smooth, monolithic, free of coarse aggregate and debris.
b. Waterproofing cured and free of solvent.

2. Place mastic adhesive compatible with panels and waterproofing in six large, equally-spaced spots on non-fabric side of panels.

a. Install first panel vertically, with long edge flush with corner and fabric flap on right.
b. Place fabric flap on horizontal edge at bottom of panel and position to prevent backfill from entering channels.
c. Ensure that fabric on long edge of panel overlaps previous panel.
d. Continue until corner is reached. Cut and install corner panels.
e. Use adhesive or staples to hold flap in place.
f. Install additional loose filter fabric to ensure that gaps are covered.

3. Multiple tier installation:

a. Install in manner similar to that used on lower tier.
b. Ensure that fabric flap of upper panels overlaps lower panels.

4. Top edge finishing: If top edge of panels is below grade, seal edge to prevent soil entry using J or Z-shaped channel, sheathing tape, or soil fabric.
5. Above grade installation: If panels extend above grade, protect exposed area from physical damage and ultraviolet exposure using mechanically attached protection.

6. Connect panels to subsurface drainage system.

3.5 INSTALLATION - CEMENT FACED INSULATING SHEATHING

A. Steel and Wood Studs:

1. Install sheathing horizontally with long dimension perpendicular to studs.
2. Locate panel ship-lap joint on studs.
3. Fastener at 6 inches on center on panel joint and maximum 6 inches on center at intermediate studs if studs are 16 inches or less on center and 4-1/2 inches on center if studs are 24 inches on center.
4. Use self drilling, corrosion resistant screws with 5/8 inch pancake head with square or star drive head as provided by panel manufacturer.

B. Concrete and Masonry Substrates:

1. Place 1/4 inch beads of non-expanding urethane adhesive to foam side of panel along four outer edges and at 12 inches from long edge of panel running full length of panel.
2. Place corrosion-resistant masonry fasteners maximum 12 inches on center over entire panel surface.
3. Coat heads and panel joints with waterproofing compound supplied by panel manufacturer.

C. Seal joints with fiberglass mesh tape embedded in waterproofing compound supplied by panel manufacturer.

3.6 INSTALLATION - CEMENT FACED INSULATED PERIMETER WALL PANELS

A. Surfaces to Receive Panels: Flat, sound, clean, and free from irregularities and or jagged surfaces.

B. Lay out panels to maximize board sizes. Do not use boards less than 6 inches wide.

C. Install panels in orientation to maximize full sheets.

D. Install fastening clips and cap flashings.

3.7 PROTECTION

A. Protect installed products from damage during construction.

END OF SECTION 07 44 74

SECTION 07 46 46 - FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes fiber-cement siding soffit.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
2. Section 07 25 00 "Weather Barriers" for weather-resistive barriers.

1.3 COORDINATION

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

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

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

B. Samples for Initial Selection: For fiber-cement siding including related accessories.

C. Samples for Verification: For each type, color, texture, and pattern required.

1. 12-inch- long-by-actual-width Sample of siding.
2. 12-inch- long-by-actual-width Samples of trim and accessories.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fiber-cement siding.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

C. Research/Evaluation Reports: For each type of fiber-cement siding required, from ICC-ES.

D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

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

1. Furnish full lengths of fiber-cement siding including related accessories, in a quantity equal to 2 percent of amount installed.

1.9 QUALITY ASSURANCE

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

1. Build mockups for fiber-cement siding including accessories.

    a. Size: 48 inches long by 60 inches high.
    b. Include outside corner on one end of mockup.

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.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with labels intact until time of use.

B. Store materials on elevated platforms, under cover, and in a dry location.

1.11 WARRANTY

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

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

a. Structural failures including cracking and deforming.
b. Deterioration of materials beyond normal weathering.
c. .

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SIDING

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. CertainTeed Corporation.
b. James Hardie Building Products, Inc.
c. Nichiha Fiber Cement.

B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.

C. Nominal Thickness: Not less than 5/16 inch.

D. Vertical Pattern: 48-inch- wide sheets

E. Panel Texture: 48-inch- wide sheets with smooth texture.

F. Factory Priming: Manufacturer's standard acrylic primer.

2.3 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.

1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.

B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:

1. Door and window casings.
2. Fasciae.
3. Moldings and trim.

C. Flashing: Provide aluminum flashing complying with Section 07 62 00 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

1. Finish for Aluminum Flashing: High-performance organic finish.

D. Fasteners:

1. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
2. For fastening fiber cement, use stainless-steel fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

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

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.
2. Install fasteners no more than 24 inches o.c.

B. Install joint sealants as specified in Section 07 92 00 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 46

SECTION 07 52 16 - STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Styrene-butadiene-styrene (SBS)-modified bituminous membrane roofing.
2. Roof insulation.

B. Related Requirements:

1. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
2. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to Work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.

7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Crickets, saddles, and tapered edge strips, including slopes.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

D. Samples for Verification: For the following products:

1. Cap sheet, of color required.
2. Flashing sheet, of color required.

3. Walkway pads or rolls, of color required.

1.5 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

B. Qualification Data: For Installer and testing agency.

C. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of complying with performance requirements.

D. Product Test Reports: For components of membrane roofing system, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Research/Evaluation Reports: For components of membrane roofing system, from ICC-ES.

F. Environmental Product Declarations: For the following product types, obtain products with Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025. Industry-wide EPDs must demonstrate that the manufacturer is a member of the publishing body responsible for the product of the EPD.

1. Insulation boards.

G. Field quality-control reports.

H. Statement of Application: In addition to other specified reports and certificates, submit a statement signed by Contractor and Roofing Subcontractor, stating that the primers, roofing, flashing, roof insulation comply with these Specifications, and that the examination, substrate preparation and installation methods complied with the manufacturer's printed instructions and were proper and adequate for the condition of installation and use.

I. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed and listed in FM Approvals' RoofNav for membrane roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.Final Inspection: Manufacturer's representative shall provide a comprehensive final inspection after completion of the roof system. All application errors must be addressed and final punch list completed.

C.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

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

1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, and other components of roofing system.
2. Warranty Period: 20 years from date of Substantial Completion, NDL.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Firestone Building Products.
2. GAF Materials Corporation.
3. Johns Manville.
4. Siplast, Inc.

B. Source Limitations: Obtain components including roof insulation for roofing system from manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:

1. Corner Uplift Pressure: 73 lbf/sq. ft..
2. Perimeter Uplift Pressure: 61 lbf/sq. ft..
3. Field-of-Roof Uplift Pressure: 42 lbf/sq. ft..

D. Solar Reflectance Index (SRI): Three-year-aged SRI not less than 64 or initial SRI not less than 82 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

E. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

F. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 ROOFING SHEET MATERIALS

A. Roofing Membrane Sheet: ASTM D 6164/D 6164M, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); smooth surfaced; suitable for application method specified.

B. Granule-Surfaced Roofing Cap Sheet: ASTM D 6164/D 6164M, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); granule surfaced; suitable for application method specified, and as follows:

1. Granule Color: White.

2.4 BASE FLASHING SHEET MATERIALS

A. Backer Sheet: ASTM D 6164/D 6164M, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); smooth surfaced; suitable for application method specified.

B. Glass-Fiber Fabric: Woven glass-fiber cloth, treated with asphalt, complying with ASTM D 1668, Type I.

2.5 AUXILIARY ROOFING MATERIALS

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

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:

    a. Plastic Foam Adhesives: 50 g/L.
    b. Gypsum Board and Panel Adhesives: 50 g/L.
    c. Multipurpose Construction Adhesives: 70 g/L.
    d. Fiberglass Adhesives: 80 g/L.
    e. Contact Adhesives: 80 g/L.
    f. Other Adhesives: 250 g/L.
    g. Nonmembrane Roof Sealants: 300 g/L.
    h. Sealant Primers for Nonporous Substrates: 250 g/L.
    i. Sealant Primers for Porous Substrates: 775 g/L.

3. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Asphalt Primer: ASTM D 41/D 41M.

C. Cold-Applied Adhesive: Roofing system manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with roofing membrane and base flashings.

D. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.

E. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

G. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 sieve and 98 percent of mass retained on No. 40 sieve, color to match roofing.

H. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.6 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch thick, factory primed.

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. Georgia Pacific Corporation; Dens Deck Prime.
b. USG Corporation; Securock Glass Mat Roof Board.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate board to roof deck.

2.7 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following as acceptable to manufacturer:

a. Atlas Roofing Corporation.
b. Carlisle SynTec Incorporated.
c. Dyplast Products.
d. Firestone Building Products.
e. GAF Materials Corporation.
f. Hunter Panels.
g. Insulfoam LLC; a Carlisle company.
h. Johns Manville.
i. Rmax, Inc.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.8 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
2. Full-spread spray-applied, low-rise, two-component urethane adhesive.

D. Insulation Cant Strips: ASTM C 728, perlite insulation board.

E. Tapered Edge Strips: ASTM C 728, perlite insulation board.

F. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.

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. Georgia Pacific Corporation; Dens Deck Prime.

G. Cover Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, [1/4 inch] [3/8 inch] [1/2 inch] [5/8 inch] thick.

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

a. USG Corporation; Securock Gypsum-Fiber Roof Board.

H. Substrate Joint Tape: 6- or 8-inch- wide, coated, glass fiber.

2.9 WALKWAYS

A. Walkway Pads: Reinforced asphaltic composition pads with slip-resisting mineral-granule surface, manufactured as a traffic pad for foot traffic and acceptable to roofing system manufacturer, [3/8 inch] [1/2 inch] [3/4 inch] thick, minimum.

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 roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 "Steel Decking."
4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
6. Verify that concrete-curing compounds that impair adhesion of roofing components to roof deck have been removed.

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

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 INSTALLATION, GENERAL

A. Comply with roofing system manufacturer's written instructions.

B. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 SUBSTRATE BOARD INSTALLATION

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.5 INSULATION INSTALLATION

A. Install one lapped base-sheet course and mechanically fasten to substrate according to roofing system manufacturer's written instructions.

B. Nailer Strips: Mechanically fasten 4-inch nominal- width wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:

1. 16 feet apart for roof slopes greater than 1 inch per 12 inches but less than 3 inches per 12 inches.
2. 48 inches apart for roof slopes greater than 3 inches per 12 inches.

C. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing system with vertical surfaces or angle changes greater than 45 degrees.

D. Install tapered insulation under area of roofing to conform to slopes indicated.

E. Install insulation with long joints of insulation in a continuous straight line, with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

F. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

G. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

H. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

I. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

J. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
2. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

K. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck. Tape joints if required by roofing system manufacturer.

1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.6 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" and as follows:

1. Deck Type: I (insulated).
2. Adhering Method: L (cold-applied adhesive).
3. Number of Glass-Fiber Base-Ply Sheets: One.
4. Number of SBS-Modified Asphalt Sheets: One.
5. Surfacing Type: M (mineral-granule-surfaced cap sheet) .

B. Start installation of roofing in presence of manufacturer's technical personnel.

C. Where roof slope exceeds 1/2 inch per 12 inches, install roofing membrane sheets parallel with slope.

1. Backnail roofing sheets to substrate according to roofing system manufacturer's written instructions.

D. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.

2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.7 BASE-SHEET INSTALLATION

A. Install lapped base-sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:

1. Mechanically fasten to substrate.

3.8 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. Install modified bituminous roofing sheet and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:

1. Adhere to substrate in cold-applied adhesive.
2. Unroll roofing sheets and allow them to relax for minimum time period required by manufacturer.

B. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

1. Repair tears and voids in laps and lapped seams not completely sealed.
2. Apply roofing granules to cover exuded bead at laps while bead is hot.

C. Install roofing sheets so side and end laps shed water.

3.9 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:

1. Prime substrates with asphalt primer if required by roofing system manufacturer.
2. Backer-Sheet Application: Mechanically fasten backer sheet to walls or parapets. Adhere backer sheet over roofing membrane at cants in cold-applied adhesive.
3. Flashing-Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive at rate required by roofing system manufacturer.

B. Extend base flashing up walls or parapets a minimum of 8 inches above roofing membrane and 4 inches onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

1. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.

D. Install roofing cap-sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.

E. Roof Drains: Set 30-by-30-inch metal flashing in bed of asphaltic adhesive on completed roofing membrane. Cover metal flashing with roofing cap-sheet stripping, and extend a minimum of 6 inches beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.

1. Install stripping according to roofing system manufacturer's written instructions.

3.10 WALKWAY INSTALLATION

A. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size, according to walkway pad manufacturer's written instructions.

1. Set walkway pads in cold-applied adhesive.

B. Install roof traffic pad in accordance with manufacturer's instructions.

3.11 FIELD QUALITY CONTROL

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

B. Test Cuts: Remove test specimens to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:

1. Determine approximate quantities of components within roofing membrane according to ASTM D 3617.
2. Examine test specimens for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 of ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
3. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

D. Roofing system will be considered defective if it does not pass tests and inspections.

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.12 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

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

3.13 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <**Insert name of Owner**>.
2. Address: <**Insert address**>.
3. Building Name/Type: <**Insert information**>.
4. Address: <**Insert address**>.
5. Area of Work: <**Insert information**>.
6. Acceptance Date: _____.
7. Warranty Period: <**Insert time**>.
8. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

    a. lightning;
    b. peak gust wind speed exceeding 115 mph;
    c. fire;
    d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. vapor condensation on bottom of roofing; and
    g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 52 16

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed roof drainage system.
2. Formed low-slope roof flashing and trim.
3. Formed wall flashing and trim.
4. Formed equipment support flashing.
5. Formed overhead-piping safety pans.

B. Single Subcontract Responsibility: Refer to roofing sections for the requirements of single subcontract responsibilities for sheet metal flashing and trim.

1.2 ACTION SUBMITTALS

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

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. Shop Drawings: Submit shop drawings showing layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.

D. Samples: Submit 8 inches x 8 inches (200 x 200 mm) square samples of sheet metal flashing, in the specified finish.

1.3 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Subcontract the sheet metal flashing and trim work to a firm which is specialized in the fabrication and installation of sheet metal flashing and trim and who has successfully installed work similar in design and extent to that required for the project, in not less than three projects of similar scope to the satisfaction of the Architect, and whose work has resulted in construction with a record of successful in-service performance for a period of 5 years. .

1. For copings and roof edge flashings that are FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved.

B. Sheet Metal Flashing and Trim Reference Standards: Comply with the industry standard sources below. Where sheet metal flashing and trim work details have not been specifically detailed on the drawings or specified the Contractor shall submit, for the Architect's approval, proposed sheet metal detailing. The primary source for proposed sheet metal detailing shall come from the industry standard sources below.

1. SMACNA's Architectural Sheet Metal Manual.
2. NRCA's Roofing and Waterproofing Manual.
3. ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roof Systems except where the Performance Requirements are more stringent.

C. Sealant Compatibility and Adhesion Testing: Use sealant manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

D. Design Modifications: Submit design modifications necessary to meet the performance requirements and field coordination. Variations in details or materials which do not adversely affect the appearance, durability or strength of components shall be submitted to the Architect for review. Maintain the general design concept without altering size of members, profiles and alignment.

1.5 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

1.6 WARRANTY

A. Furnish written warranty against water leakage resulting from defects of materials or workmanship. Upon notification of such defects, within the warranty period, make the necessary repairs and replacements at the convenience of, and no cost to, the Owner. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

1. Warranty period shall be 5 years after the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install exterior wall and roofing sheet metal flashing and trim capable of resisting the wind forces greater than or equal to those shown on Structural Drawings for components and cladding.

C. SPRI Wind Design Standard: Manufacture and install copings tested according to SPRI ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from surface temperatures ranging from +10 degrees F. to +180 degrees F., without buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements.

1. Dimensions shown on Drawings are based on an assumed design temperature of +70oF. Fabrication and installation procedures shall take into account the ambient temperature range at the time of the respective operations.

E. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

2.2 SHEET METALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality, mill phosphatized for field painting.

B. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; structural quality.
2. Exposed Finishes: Apply the following coil coating:

a. High-Performance Organic Finish: Two -coat thermocured system containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2604, except as modified for below:

1) Humidity and Salt Spray Resistance: 1000 hours.
2) Color: As selected by Architect from manufacturer's full range.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Underlayment: Self-Adhering, High-Temperature Sheet: 0.76 mm thick, self adhering, self sealing, underlayment consisting of slip-resisting high density cross laminated polyethylene-film top surface laminated to layer of butyl rubber based adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 116 deg C ; ASTM D 1970.
2. Product Reference: Grace, W. R. & Co.; Ultra.

C. Fasteners: Wood screws, same metal as flashing/sheet metal, annular threaded nails, self-tapping screws, and other suitable fasteners designed to withstand design loads.

D. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer, use a noncorrosive rosin flux over tinned surfaces.

E. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

F. Elastomeric Sealant: ASTM C 920 and Section 07 92 00 "Joint Sealants," elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

H. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound.

I. Bituminous Coating: Cold-applied bituminous paint complying with ASTM D 1187, compounded for 15 mil dry film thickness per coat.

J. Wood Nailer Strips: Provide wood nailer strips, fabricated to sizes indicated, from lumber complying with the requirements of Section 06 10 53 "Miscellaneous Rough Carpentry" and fire retardant treated by pressure process using chemical solution which is non-hygroscopic and non-corrosive to sheet metal used.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with the referenced standards that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored. Cleats shall be 2 inches wide by nominal 3 inches long typically, minimum 0.0187 inch thick, punch for minimum 2 nail or screw holes. One end shall be locked into seams, or into folded edge of sheet metal sheets, the other end shall be secured with nails or screws and folded back over nail or screw heads.

2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Manufactured Hanger Style: < **Insert description.**>
2. Fabricate downspouts from the following material:

    a. Galvanized Steel: 0.0217 inch thick.

B. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes .

1. Fabricate conductor heads from the following material:

    a. Galvanized Steel: 0.0276 inch thick.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96 inches long, but not exceeding 10 foot long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder watertight.

1. Joint Style: Butt, with 6-inch- wide exposed cover plates.

2. Fabricate copings from the following material:

    a. Galvanized Steel: 0.0396 inch thick.

B. Roof and Roof to Sheet Metal Roof Edging Transition Expansion-Joint Cover: Fabricate from the following material:

1. Galvanized Steel: [0.0336 inch] <**Insert thickness**> thick.

C. Base Flashing: Fabricate from the following material:

1. Galvanized Steel: [0.0276 inch] <**Insert thickness**> thick.

D. Counterflashing and Flashing Receivers: Fabricate from the following material:

1. Aluminum-Zinc Alloy-Coated Steel: [0.0217 inch] <**Insert thickness**> thick.
2. Prepainted, Metallic-Coated Steel: [0.0217 inch] <**Insert thickness**> thick.

E. Roof-Penetration Flashing: Fabricate from the following material:

1. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.

F. Roof-Drain Flashing: Fabricate from the following material:

1. Stainless Steel: 0.0156 inch thick.

2.7 WALL SHEET METAL FABRICATIONS

A. Openings Flashing in Frame Construction: Fabricate through wall head, sill,base course/foundation, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high end dams. Fabricate from the following material:

1. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch thick.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:

1. Galvanized Steel: 0.0276 inch thick.

B. Overhead-Piping Safety Pans: Fabricate from the following material:

1. Galvanized Steel: 0.0396 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Nailer and Underlayment Installation for Copings:

1. Provide wood nailers shown to properly install the coping. Form to shapes indicated and cut as required for true line and level of attached work. Set to required levels and lines. Allow approximately 1/8" between nailer ends and offset joints a minimum of 12" in multiple layers. Locate nailers to comply with requirements for attaching other construction.
2. Utilize mechanical fasteners that will have no detrimental effect on the components of the coping. Recess fasteners flush with surfaces. Fasten in accordance with FM 1-49 standards and the coping manufacturers recommendations.
3. Underlayment Installation: Install a course of self adhering high temperature sheet underlayment directly over nailers in accordance with the underlayment manufacturers instructions to the extent indicated on the drawings. Lap ends of underlayment lengths a minimum of 4 inches.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of underlayment.
2. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

D. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

E. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, and butyl sealant.

F. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

G. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

H. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
2. Aluminum: Use aluminum or stainless-steel fasteners.
3. Copper: Use copper or stainless-steel fasteners.
4. Stainless Steel: Use stainless-steel fasteners.

I. Seal joints with butyl sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant.

J. Soldered Joints: Edges of sheets to be soldered shall be in close contact at every point along the joint before soldering. Edges of all sheets of sheet metal to be soldered shall be tinned with solder on both sides for a minimum width of 1-1/2 inches. Where specified, all seams shall be thoroughly soldered to produce watertight joints. All soldering shall be done slowly with well heated metal - to heat sheet thoroughly and to sweat solder completely through full width of seam. Ample solder shall be used and seam shall show at least one full inch of evenly flowed solder. Wherever possible all soldering shall be done in flat position. Remove every trace of flux residue from metal promptly after tinning. Comply with manufacturer's recommended methods for cleaning and neutralization. Clean exposed surfaces of sheet metal flashing and trim of every substance which is visible or might cause corrosion of metal surfaces. Use soldering irons (3 lb. Minimum each). Do not use abrasives in preparing the sheet metal surfaces for soldering. All exposed parts of finished soldered joints shall be smooth and free of smeared solder.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to the referenced standards and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Downspouts: Join sections with 1-1/2 inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

C. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

D. Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch below gutter discharge.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements and the referenced standards. Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49.

1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 16 inch centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49.

1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 16 inch centers.
2. Anchor interior leg of coping with screw fasteners and washers at 18 inch centers.

D. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

E. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

F. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Secure in a waterproof manner. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant.

G. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal with butyl sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Openings Flashing in Frame Construction: Install continuous through wall head, sill, and similar flashings to extend 4 inches beyond wall openings.

3.6 MISCELLANEOUS SHEET METAL FABRICATION INSTALLATION

A. Overhead-Piping Safety Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.

B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Seal flashing with elastomeric sealant to equipment support member.

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces for uniform oxidation and weather exposure; neutralize flux materials; clean off excess solder and sealants; and remove strippable films, if any.

B. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, and pieces of flashing. Maintain in a clean condition during construction.

C. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof curbs.
2. Equipment supports.
3. Roof walkways.
4. Snow guards.

1.2 ACTION SUBMITTALS

A. Product Data: For each product indicated.

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

D. Coordination Drawings: Roof plans drawn to scale and coordinating penetrations and roof-mounted items.

E. Samples: For each exposed finish.

1.3 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

1.4 QUALITY ASSURANCE

A. Standards: Comply with the following:

1. SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
2. NRCA's "Roofing and Waterproofing Manual" details for installing units.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum:

1. Sheet: ASTM B 209 for alclad alloy 3005H25 or alloy and temper required to suit forming operations, with mill finish, unless otherwise indicated.
2. Extrusions: ASTM B 221 alloy 6063-T52 or alloy and temper required to suit structural and finish requirements, with mill finish, unless otherwise indicated.

B. Galvanized Steel Sheet: ASTM A 653/A 653M with G90; commercial steel, unless otherwise indicated.

1. Structural Quality: Grade 40, where indicated or as required for strength.

C. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M with Class AZ-50 coating, structural quality, Grade 40, or as required for strength.

D. Insulation: Manufacturer's standard rigid or semirigid glass-fiber board of thickness indicated.

E. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches thick.

F. Security Grilles: 3/4 inch diameter, hardened steel bars spaced 6 inches o.c. in one direction and 12 inches o.c. in other. Weld bar intersections and ends of bars to structural frame or primary curb walls. Clean and paint with rust-inhibitive metal primer.

G. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.

1. Provide nonremovable fastener heads.

H. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

I. Bituminous Coating: SSPC-Paint 12, solvent-type bituminous mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15 mil dry film thickness per coating.

J. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

K. Elastomeric Sealant: Recommended by unit manufacturer that is compatible with joint surfaces; ASTM C 920, Type S, Grade NS, Class 25.

L. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.2 ROOF CURBS AND EQUIPMENT SUPPORTS

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

1. AES Industries, Inc.
2. Colony Custom Curbs.
3. Commodity Products Company, Inc.
4. Conn-Fab Sales, Inc.
5. Curbs Plus, Inc.
6. Custom Curb, Inc.
7. Gieske Custom Metal Fabricators.
8. Goeller Enterprises.
9. LMCurbs.
10. Loren Cook Company.
11. Metallic Products Corporation.
12. Pate Co. (The).
13. Roof Products & Systems Corp.
14. ThyCurb, Inc.
15. Uni-Curb, Inc.
16. Vent Products Co., Inc.

B. General: Units capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Coordinate dimensions with equipment to be supported.

1. Provide preservative-treated wood nailers at tops of units and formed flange at perimeter bottom for mounting to roof.
2. Fabricate units to minimum height of 8 inches, unless otherwise indicated.
3. Where slope of roof deck exceeds 1/4 inch per foot, fabricate support units with height tapered to match slope to level tops of units.

C. Manufactured Roof Curbs:

1. Fabrication: Unless otherwise indicated or required for strength, fabricate units from minimum 0.063 inch thick, sheet aluminum with welded corner joints.
2. Insulation: Manufacturer's standard rigid or semirigid insulation where indicated.
3. Cants: Formed cants and base profile coordinated with roof insulation thickness.

D. Equipment Supports: Capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Coordinate dimensions with equipment to be supported.

1. Fabrication: Unless otherwise indicated or required for strength, fabricate units from minimum 0.063 inch thick, sheet aluminum with welded corner joints.

2.3 ROOF WALKWAYS

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

1. GS Metals Corp.
2. Unistrut Corporation.
3. Approved equal, as reviewed by Architect.

B. Metal-Grating Type: Formed-metal plank gratings of C-shaped channels rolled from heavy sheet metal and punched in serrated diamond shape to produce raised slip-resistant surface and drainage holes. Provide support framing, brackets, connectors, nosings, and other accessories and components needed for complete installation. Include step units for changes in elevation.

1. Material: 0.07 inch, structural-quality, galvanized steel sheet.
2. For Flat Roofs: Provide resilient, hard rubber pads under each support unit to isolate supports from and protect roof membrane.
3. For Sloped Roofs: Provide support stands designed for type of roof installed.

2.4 SNOW GUARDS

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

1. Berger Building Products Corp.
2. LMCurbs.
3. M. J. Mullane Company.
4. Polar Blox, Inc.
5. Riddell & Company, Inc.
6. Sieger Snow Guards, Inc.
7. Sno-Gem, Inc.
8. Snojax, Inc.
9. Snow Management Systems.
10. Steel Tile Company.
11. ThyCurb, Inc.
12. Vermont Slate and Copper Services, Inc.
13. Zaleski Snow-Guard and Roofing Specialties Inc.

B. General: Prefabricated, noncorrosive units designed to be installed without penetrating roof and complete with predrilled holes, clamps, or hooks for anchoring.

1. Metal Type: Prefabricated, copper or bronze and copper units, designed for use with type of roof specified.
2. Metal Bar Type: Consisting of aluminum or stainless-steel rods or bars held in place by supports clamped to vertical ribs of standing-seam roof.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction to ensure that combined elements are waterproof and weathertight. Anchor roof accessories securely to supporting structural substrates so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.

B. Install roof accessory items according to construction details in NRCA's "Roofing and Waterproofing Manual," unless otherwise indicated,

C. Separation: Separate metal from incompatible metal or corrosive substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.

D. Flange Seals: Unless otherwise indicated, set flanges of accessory units in a thick bed of roofing cement to form seal.

E. Cap Flashing: Where required as component of accessory, install cap flashing to provide waterproof overlap with roofing or roof flashing (as counterflashing). Seal overlap with thick bead of mastic sealant.

F. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

G. Snow Guards: Install according to manufacturer's written recommendations and NRCA's "Steep Roofing Manual." Unless otherwise indicated, locate snow guards at 18 inches o.c. horizontally, and at every other course vertically, beginning 24 inches up from gutter. Stagger snow guard location by 9 inches between courses.

H. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

END OF SECTION 07 72 00

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes sealants for the following applications:

1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:

    a. Control and expansion joints in cast-in-place concrete.
    b. Joints between tilt-up cast-in-place concrete units.
    c. Joints between architectural precast concrete units.
    d. Control and expansion joints in unit masonry.
    e. Joints in stone cladding.
    f. Joints in glass unit masonry assemblies.
    g. Joints in exterior insulation and finish systems.
    h. Joints in Portland cement plaster (stucco) systems.
    i. Joints between metal panels.
    j. Joints between glass for structural glazing.
    k. Joints between different materials listed above.
    l. Perimeter joints between materials listed above and frames of doors and windows and louvers.
    m. Other joints as indicated.

2. Exterior joints in the following horizontal traffic surfaces:

    a. Control and expansion joints in brick pavers.
    b. Control, expansion, and isolation joints in cast-in-place concrete slabs.
    c. Control and expansion joints in joints between precast concrete tee flanges and shapes.
    d. Around perimeters of parking garage and balcony deck drains.
    e. Joints between architectural precast concrete paving units.
    f. Joints in stone paving units, including steps.
    g. Tile control and expansion joints.
    h. Joints between different materials listed above.
    i. Other joints as indicated.

3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints of exterior openings where indicated.
    c. Tile control and expansion joints.
    d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
    e. Joints on underside of precast beams and planks.

f. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
g. Joints between plumbing fixtures and adjoining walls, floors, and counters.
h. Joints between glass and glass to adjoining walls.
i. Other joints as indicated.

4. Interior joints in the following horizontal traffic surfaces:

a. Control and expansion joints in cast-in-place concrete slabs.
b. Control and expansion joints in stone flooring.
c. Control and expansion joints in brick flooring.
d. Control and expansion joints in tile flooring.
e. Other joints as indicated.

B. Single Subcontract Responsibilities: Refer to [**Section 08 44 13 "Glazed Aluminum Curtain Walls,"**] [**Section 08 41 13 "Aluminum-Framed Entrances and Storefronts,"**] [**and**] [**Section 08 51 13 "Aluminum Windows"**] for requirements applicable to single subcontract responsibility.

1.2 ACTION SUBMITTALS

A. Product Data: Submit product data for each joint-sealant product indicated and the following:

1. Written certification from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use(s) indicated as verified through manufacturer's in-house testing laboratory.

a. Test results for all job specific concealed and exposed (custom colored) sealants confirming compatibility and adhesion are mandatory for all materials in contact with exterior glazing, curtain wall components, metal panels, architectural precast concrete, and exterior stone cladding, prior to [**mockup and testing**] [**erection of sample installations**].
b. Complete instructions for handling, storage, mixing, priming, installation, curing and protection of each type of sealant.

2. Laboratory and field test results confirming joint preparation (cleaning/priming), chemical compatibility, and proper adhesion for specified joint sealant for each of the joint profiles and substrate materials included in the design of this Project.

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. CALgreen Submittals:

1. Product Data for Section 5.504.4.1: For Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers and caulks, provide documentation including printed statement of VOC content showing compliance with SCAQMD Rule 1168 VOC limits and CCR (California Code of Regulations) Title 17 for aerosols.

2. Product Data for Section 5.504.4.1.2: Provide documentation for aerosol adhesives, and smaller unit sizes of adhesives, sealant, and caulking compounds (in units of product, less packaging, which do not weigh more than one (1) pound and do not consist of more than sixteen (16) fluid ounces) comply with statewide VOC standards and prohibitions on use of certain toxic compounds, of CCR Title 17, commencing with Section 94507.
3. [**Product Certificates for Section A5.405.1: For products and materials required to comply with requirements for regional materials, provide certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. For the purposes of this requirement, "regional" is interpreted to mean within 500 miles of the project location or within the State of California.**]

D. Samples: Submit samples of each type and color of exposed joint sealant required. Provide fully cured joint sealant samples in 3/4 inch wide joints 12 inches long formed between two strips of material to be sealed as they will appear on the Project.

1.3 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

B. Warranties: Submit specified warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Exposed sealant work including, but not limited to, sealants used for air and weatherseals which are external to [**curtain wall systems at their perimeter,**][**metal panel to panel joints at their perimeter,**][**skylights,**][**sloped glazing,**][**architectural precast to precast joints,**][**exterior stone cladding joints),**] [**face brick to face brick joints**] shall be performed by one firm specializing in the installation of sealants who has successfully produced work comparable to this Project, in not less than three projects of similar scope to the satisfaction of the Architect, and whose work has resulted in construction with a record of successful in-service performance for a period of 10 years. Concealed sealant work (sealants which are internal to [**curtain wall systems,**] [**metal panels,**][**skylights,**][**sloped glazing**]necessary for air and moisture penetration resistance under applied loads) shall be the responsibility of the subcontractor responsible for the final design, installation, and performance of the respective system.

B. Source Limitations: Obtain each type of joint sealant, and each type of structural silicone adhesive, from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing (All Exterior Wall Sealants Only): Submit to joint sealant manufacturers, prior to full size building [**mockup(s)**] [**sample installation(s)**], samples of materials that will contact or affect, by direct or indirect chemical or mechanical means, exterior wall joint sealants for compatibility and adhesion testing below.

1. General: Test results confirming compatibility and adhesion are mandatory for all concealed and exposed sealant materials in contact with [**exterior glazing,**] [**exterior precast,**] [**exterior stone cladding,**] [**face brick,**] other sealants, flashings, metal framing, and shims, prior to[**the construction of full sized mockup and testing**] [**the construction of full sized sample installation(s)**].

   a. Schedule sufficient time for testing and analysis of results to prevent delay in the progress of the work.

      1) It is anticipated that a minimum of 3 months will be required to complete preconstruction sealant compatibility and adhesion testing.

   b. Investigate materials that fail compatibility and adhesion testing and obtain sealant manufacturer's written recommendations for corrective measures, which may include the use of primers, cleaners, cleaning measures, curing time, temperature limitations (surface and air), humidity conditions, moisture content of substrate, etc.

   c. Definitions:

      1) Compatibility: The capability of the sealant materials and substrates to be placed in direct contact with each other and maintain their required physical, chemical and visual qualities with the absence of softening, staining, oil exudation, discoloration or other detrimental, deleterious or degradative effects caused by chemical interactions.
      2) Adhesion: The mechanical or chemical ability of the sealant materials and substrates to adhere or bond together at their interface.

   d. Specimen Sizes and Shapes: As required by the manufacturer's testing laboratory for the tests listed, unless otherwise specified.

2. Tests Required:

   a. Adhesion in Peel Testing:

      1) Test Methods:

         a) Comply with ASTM C 794 "Adhesion and Peel of Elastomeric Joint Sealants," modified to include Project specific substrates and to report cohesive or adhesive failure mode. Samples of each [**exterior precast,**] [**exterior stone cladding,**] [**exterior face brick,**]other sealants, flashings, metal framing in contact with the concealed and exposed sealant materials are required to be tested.

b) Comply with ASTM C 1135 "Determining Tensile Adhesion Properties of Structural Sealants," modified to include Project specific substrates and the following. Sealant manufacturer's modified interpretations of ASTM C 1135 will not be permitted. Samples of each exterior structural glazing and metal framing in contact with the structural sealant materials are required to be tested. In addition to the testing being performed under the standard environmental conditioning required of ASTM C 1135; the Contractor shall prepare, and test, additional specimens for each Project-specific environmental condition under which the sealant will be applied and cured.

2) All specimens shall be tested for primed and unprimed performance.
3) Report:

a) Date(s) of testing.
b) Project identification.
c) Test method (as identified herein).
d) Specimen substrate(s) tested.
e) Sealant(s) tested.
f) Substrate preparation (cleaning materials, methods and primers used).
g) Test results for each specimen tested (type of failure - adhesive or cohesive - force measured at failure in pounds per lineal inch).
h) Recommendations. Where testing shows equal or better performance without a primer, a primer will not be required.
i) Additional remarks, if any (i.e., color change of substrate or sealant, voids in the body of the sealant when examined in cross section, blistering, bubbling, sealant softening, or evidence of improperly mixed or cured sealant).

b. Compatibility Testing: This test method describes an accelerated laboratory procedure to determine if the proposed sealant materials and substrates are compatible.

1) Test Methods:

a) Comply with ASTM C 1248 "Staining of Porous Substances by Joint Sealants," modified to include Project specific substrates. Samples of each [**exterior precast,**][**exterior stone cladding,**] [**exterior face brick,**]and other sealants, in contact with the concealed and exposed sealant materials are required to be tested.
b) Comply with ASTM C 1087 "Determining Compatibility of Liquid Applied Sealants with Accessories Used in Structural Glazing Systems," modified to include Project specific substrates. Sealant manufacturer's modified interpretations of ASTM C 1087 will not be permitted. Samples of each exterior dry glazing gasket (if any), spacers, shims and setting blocks proposed for use in contact with the structural sealant materials are required to be tested.

2) All specimens for ASTM C 1248 testing shall be tested for primed and unprimed performance.
3) Report:

a) Date(s) of testing.
b) Project identification.
c) Test method (as identified herein).
d) Substrate preparation (cleaning materials, methods and primers used).
e) Name of sealant, type of sealant, rated movement capability and identifying batch number.
f) Substrates used.
g) Testing Equipment: Manufacturer of apparatus, type of lamps.
h) Statement describing curing conditions if other than at standard conditions.
i) Description of, and reasons for, any variations from the test procedure.
j) Description of test effects observed, such as change in finished surface appearance, discoloration into the substrate, adhesion failure, or other characteristics; average measurement of stain width and depth.
k) Recommendations. Where testing shows equal or better performance without a primer, a primer will not be required.
l) Additional remarks, if any (i.e., color change of substrate or sealant, voids in the body of the sealant when examined in cross section, blistering, bubbling, sealant softening, or evidence of improperly mixed or cured sealant).

c. Preconstruction Field-Adhesion Testing: Before installing exposed exterior elastomeric sealants, field test their adhesion to joint substrates as follows:

1) Locate test joints where indicated or, if not indicated, as directed by Architect.
2) Conduct field tests for each type of exposed exterior elastomeric sealant and joint substrate indicated.
3) The Architect and manufacturer's technical representative shall be present when joints are tested.
4) Test Method: Test exterior elastomeric joint sealants by hand-pull method described below:

a) Install joint sealants in 60 inch long joints using same materials and methods for joint preparation and joint-sealant installation in accordance with manufacturer's final laboratory testing recommendations. Allow sealants to cure.
b) Make knife cuts from one side of joint to the other, followed by two cuts approximately 3 inch long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from cross-cut end of 3 inch piece.

c) Use fingers to grasp 3 inch piece of sealant between cross-cut end and 1 inch mark; pull firmly down at a 90-degree angle to the joint and hold sealant in this position for ten seconds; following the ten second time duration pull sealant at a 180 degree angle parallel to the joint and hold the sealant in this position for ten seconds. Pull sealant away from joint to the distance recommended by sealant manufacturer for testing adhesion.

d) Repair joint as recommended by the sealant manufacturer.

5) Sealants evidencing adhesive failure with one or both substrates during testing, and/or a level of elongation prior to failure that is not in compliance with the performance characteristics specified herein or otherwise published by the sealant manufacturer will be subject to rejection by the Architect. Discontinue use of joint sealants, cleaning agents, primers, and application methods associated with failures documented during testing and immediately notify manufacturer and Architect for further review.

3. Report: Provide written summary of each compatibility and adhesion test.

D. Mockups and Sample Installations: Provide mockups and sample installations of sealants at locations indicated or required by the Architect. Mockups and sample installations shall represent the primary types of materials, substrate surfaces, joint size, exposure, and other conditions to be encountered in the work. Preparation, priming, application, and curing, shall comply with manufacturer's recommendations and actual proposed methods. Schedule the applications, with allowance for sufficient curing time, so that samples may be examined and necessary adjustments made at least one week prior to date scheduled for commencing installation of the work.

1. The mockups and sample installations shall be visually examined for staining, dirt pickup, shrinkage, color, general workmanship and appearance. Cut and pull the sealant from each sample joint to examine for internal bubbles or voids, adhesion, and general compatibility with substrate.
2. Mockups and sample installations are required in conjunction with the following:

a. Section 03 33 00 "Architectural Concrete."
b. Section 03 45 00 "Precast Architectural Concrete."
c. Section 03 49 00 "Glass-Fiber Reinforced Concrete (GFRC)."
d. Section 04 72 00 "Cast Stone Masonry."
e. Section 04 20 00 "Unit Masonry."
f. Section 04 26 13 "Masonry Veneer."
g. Section 04 42 00 "Exterior Stone Cladding."
h. Section 04 43 13.13 "Anchored Stone Masonry Veneer."
i. Section 04 43 13.16 "Adhered Stone Masonry Veneer."
j. Section 07 24 19 "Water-Drainage Exterior Insulation and Finish Systems (EIFS)."
k. Section 07 24 13 "Polymer-Based Exterior Insulation and Finish Systems (EIFS)."
l. Section 08 41 13 "Aluminum-Framed Entrances and Storefront."
m. Section 08 44 13 "Glazed Aluminum Curtain Walls."
n. Section 08 51 13 "Aluminum Windows."

o. Section 32 14 00 "Unit Paving."

E. Preinstallation Conference: As soon as possible after award of exterior joint sealant work, but no later than two weeks before the installation of the joint sealants, meet with Installer, Owner, Architect, installers of the substrate construction, and other work adjoining joint sealants and representatives of any other entities directly concerned with joint sealant performance. Conduct conference at Project site to comply with the following:

1. Review foreseeable methods and procedures related to sealing substrates, including but not limited to, the following:

a. Discuss substrates to be sealed, discuss as fabricated and installed condition of substrate, sealant application, flashing details, and other preparatory work.
b. Review joint sealant requirements: drawings, specifications, and other contract documents.
c. Review required submittals, both complete and incomplete.
d. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions.
e. Review schedule and intended sequence of work.
f. Review changes arising from the pre-construction mockup and performance testing program, if any.
g. Review the purpose and method of integration of field quality assurance programs developed by Contractor and suppliers/subcontractors responsible for the Work.
h. Review purpose and method of integration of field quality assurance program administered by the Owner's Exterior Wall Testing and Inspection Agency with similarly aligned programs developed by the Contractor and suppliers/subcontractors responsible for the Work.

2. Record discussion and furnish copy of recorded discussions to each attendee.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 FIELD CONDITIONS

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

1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.

2. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealant work which has failed to provide a weathertight system within specified warranty period.

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

B. Special Manufacturer's Warranties: Written warranties (weatherseal and stain resistance), signed by elastomeric sealant manufacturer agreeing to furnish elastomeric joint sealants to repair or replace those that fail to provide airtight and watertight joints, or fail in adhesion, cohesion, abrasion-resistance, stain-resistance, weather resistance, or general durability or appear to deteriorate in any other manner not clearly specified in the manufacturer's data as an inherent quality of the material within specified warranty period.

1. Warranty Period:

a. For Polyurethane Sealants: 5 years from date of Substantial Completion.
b. For Silicone Sealants: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as stated by sealant manufacturer's published data, and as substantiated by the manufacturer for each application through testing.

B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: Not more than 250 g/L.
2. Nonmembrane Roof Sealants: 300 g/L.
3. Single-Ply Roof Membrane Sealants: 450 g/L.
4. Sealant Primers for Nonporous Substrates: Not more than 250 g/L.
5. Sealant Primers for Porous Substrates: Not more than 775 g/L.

C. Low-Emitting Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers and caulks shall comply with local or regional regulations as shown in Section 01 81 23 "CALgreen Requirements."

E. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds shall comply with regulations as shown in Section 01 81 23 "CALgreen Requirements."

F. Colors: For fully concealed joints, provide manufacturer's standard color of sealant which has the best overall performance characteristics for the application shown. For exposed joints provide custom colors to match Architect's samples of the following:

1. Exterior window and curtain wall framing, each color.
2. Exterior window framing, each color.
3. Architectural precast concrete, each color.
4. Face brick, each color.
5. Decorative masonry units, each color.
6. Cast stone, each color.
7. Stone cladding, each color.
8. Metal panels, each color.
9. Walks and pavings, each color.
10. Exterior insulation finish system, each color.
11. Exterior field applied paints and coatings, each color.
12. Other exterior and interior materials, each color as indicated.

G. Manufacturer's Representative: Do not use elastomeric sealant produced by a manufacturer who will not agree to send a qualified technical representative to the Project site when requested, for the purpose of rendering advice concerning the proper installation of manufacturer's materials.

2.2 ELASTOMERIC JOINT SEALANTS

A. Silicone Sealants for Vertical Applications (Non-Sag):

1. Typical Interior Glass Wall Butt Joints: Comply with ASTM C 1184 and ASTM C 920, Type S, Grade NS, Class 50; use NT, G, and A, black color unless otherwise indicated.

a. Products and Manufacturers: One of the following:

1) DOWSIL 795; Dow Chemical Company.
2) Spectrem 2; Tremco, an RPM Co.
3) Silpruf SCS 2000; Momentive.
4) Sika, Sikasil WS 295.

2. Typical Exterior Wall Joints:

    a. Properties:

        1) Standards: Comply with ASTM C 920, Type M or S, Grade NS, Class 25 or 50; use NT, M, A and O.
        2) Performance: Non-stain, non-bleed, non-streaking to sealed and adjacent substrates. The minimum peel adhesion value after 7 day immersion shall not be less than 13 pli when tested in strict accordance with ASTM C 794 Adhesion in Peel.
        3) Cure System and Oil Content: Neutral-cure, low or medium modulus system specifically manufactured with controlled oil content to eliminate oil migration into sealed substrates and residue rundown over and onto adjacent substrates.

    b. Products and Manufacturers: One of the following:

        1) DOWSIL 756 SMS; Dow Chemical Company.
        2) Spectrem 3 or Spectrem 4-TS (Use Spectrem 1 for metal to metal joints); Tremco, an RPM Co.
        3) Silpruf NB SCS 9000 (use Silpruf SCS 2000 for metal to metal joints); Momentive.
        4) 890 NST; Pecora.

3. Structural Glazing at Exterior Curtain Walls:

    a. Structural and Weatherseal Beads for Unitized Four Side Shop Glazed Structural Silicone Curtain Wall Systems (Two-Part Silicone Sealants):

        1) Properties:

            a) Standards: Comply with ASTM C 1184 and ASTM C 920, Type M, Grade NS, Class 12.5 or 25; use NT, G, and A.
            b) Performance: The minimum tensile adhesion strength shall be 120 psi with the sealant design tensile and shear stress calculated at 20 psi resulting in a minimum 6 to 1 safety factor. Provide laboratory testing and calculations indicating product working stress and safety factors, in addition provide insulating glass manufacturer's written concurrence, based on testing to actual job production run samples of glass and framing materials, the product is proper for the uses shown and specified.
            c) Cure System: Shelf storage stable, neutral-cure, high modulus, system which is compatible and adherent to the two part insulating glass edge seals, glazing accessories and metal window frame materials being provided for the Project.
            d) Color: Black.

        2) Products and Manufacturers: One of the following:

a) DOWSIL 983 Structural Glazing and Curtainwall Adhesive/Sealant base x curing agent; Dow Chemical Company.
b) Proglaze II; Tremco, an RPM Co.
c) UltraGlaze SSG 4400; Momentive.

b. Structural and Weatherseal Beads for 2-side Field Glazed Structural Curtainwall Joints:

1) Properties:

a) Standards: Comply with ASTM C 1184 and ASTM C 920, Type S, Grade NS, Class 25 or 50; use NT, G, and A.
b) Performance: The minimum tensile adhesion strength shall be 120 psi with the sealant design tensile and shear stress calculated at 20 psi resulting in a minimum 6 to 1 safety factor. Provide laboratory testing and calculations indicating product working stress and safety factors, in addition provide insulating glass manufacturer's written concurrence, based on testing to actual job production run samples of glass and framing materials, the product is proper for the uses shown and specified.
c) Cure System: Shelf storage stable, neutral-cure, high modulus, system which is compatible and adherent to the two part insulating glass edge seals, glazing accessories and metal window frame materials being provided for the Project.
d) Color: Black.

2) Products and Manufacturers:

a) DOWSIL 995 Silicone Structural Adhesive; Dow Chemical Company.
b) Proglaze SSG; Tremco, and RPM Co.
c) UltraGlaze SSG 4000; Momentive.

B. Two Part Polyurethane Sealants for Vertical Applications (Non-Sag):

1. Typical Exterior Wall Joints (Two-Part Polyurethane Sealants):

a. Properties:

1) Standards: Comply with ASTM C 920, Type M, Grade NS, Class 25 or Class 50; use NT, M, A and O.
2) Performance: Non-stain, non-bleed, non-streaking to sealed and adjacent substrates. The minimum peel adhesion value after 7 day immersion shall not be less than 13 pli when tested in strict accordance with ASTM C 794 Adhesion in Peel.

b. Products and Manufacturers: One of the following:

1) MBCC Group Master Builders Solutions (formally BASF); MasterSeal NP 2.
2) Pecora Corporation; Dynatrol II.
3) Tremco an RPM Co,; 240FC.

C. Two-Part Polyurethane Sealant for Paving and Non-Immersed Swimming Pool Applications:

1. For Paving Applications with Slopes not Exceeding 5% (Self Leveling): ASTM C 920, Type M, Grade P, Class 25; use T (except with a Shore A hardness of 35 or greater) and I (Class 1 or 2) for water immersion; and abrasion resistant, one of the following:

a. Pecora Corporation; Urexpan NR-200.
b. Tremco, an RPM Co.; Vulkem, 445SSL.
c. Sika; Sikaflex 2c SL.

2. For Paving Applications with Slopes Exceeding 5%: ASTM C 920, Type M, Grade P "Slope Grade," Class 25; uses T (except with a Shore A hardness of 35 or greater) and abrasion resistant; one of the following:

a. Pecora Corporation; Dynatred.
b. Tremco, an RPM Co.; Vulkem, 445SSL
c. Sika; Sikaflex 2c NS TG.

D. Sealants for Contact with Food: Comply with 21 CFR 177.2600, NSF Standard 51 or USDA for use in meat and poultry processing plants, and ASTM C 920 for Type S, Grade NS, Class 25, Use NT.

1. Dow Chemical Company; 786 Silicone Sealant.
2. Pecora Corporation; 898 NST Sanitary Mildew Resistant Sealant.

E. Mildew-Resistant Silicone Sealant (use for joints at toilet fixtures, toilet room countertops and vanities, and at janitor closet mop receptor to wall transition): Complying with ASTM C 920, Type S (single component), Grade NS (non-sag), class 25, Use NT (non-traffic), Substrate uses G, A, and O; and containing a fungicide for mildew resistance; white color.

1. Products: Provide one of the following:

a. Dow Chemical Company; 786 Silicone Sealant.
b. Momentive; Sanitary SCS 1700.
c. Pecora Corporation; 898 NST Sanitary Mildew Resistant Sealant.
d. Tremco, an RPM Co.; Tremsil 200 Sanitary.

2.3 LATEX JOINT SEALANTS

A. Latex Sealant: Non-elastomeric, one part, non-sag, paintable latex sealant that is recommended for exposed applications on the interior. Complying with ASTM C 834, Type OP (opaque sealants):

1. Products: Provide one of the following:

    a. Pecora Corporation; AC-20 + Silicone.
    b. DAP Products Inc.; Alex Plus Acrylic Latex Caulk Plus Silicone.
    c. MBCC Group Master Builders Solutions (formally BASF); MasterSeal NP 520.
    d. Tremco, an RPM Co.; Tremflex 834.

2.4 PREFORMED JOINT SEALANTS

A. Preformed Silicone-Sealant System: Provide one of the following.

1. DOWSIL 123 Silicone Seal set in DOWSIL 791, or DOWSIL 795 Silicone Sealants; Dow Chemical Company.
2. Sil-Span Preformed Silicone Profile set in 864 NST Silicone Sealant; Pecora Corporation.
3. **[Silicone Extruded Sheet set in Spectrem 1 adhesive] [Spectrum Restoration Overlay Extrusion set in Spectrem 1 adhesive]**; Tremco, an RPM Co.

B. Preformed Foam Sealants: Provide manufacturer's standard preformed, precompressed, impregnated, open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent; factory produced in precompressed sizes and in roll or stick form to fit joint widths indicated; and complying with the following:

1. Properties: Permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.
2. Impregnating Agent: Manufacturer's recommended for conditions indicated.
3. Density: Manufacturer's recommended for conditions indicated.
4. Backing: Pressure-sensitive adhesive, factory applied to one side with protective wrapping.
5. Products: Provide one of the following:

    a. Emseal 25V; Emseal Joint Systems, Ltd.
    b. Wilseal 600; Tremco, and RPM Co.
    c. Illmod 600; Tremco, and RPM Co.

2.5 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: One of the following preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding backings of flexible plastic foam complying with ASTM C 1330, and of type indicated below. Select shape and density of cylindrical sealant backings in consultation with the manufacturer for proper performance in specific condition of use in each case.

1. Type C: Closed-cell polyethylene foam material with a surface skin, which is nonabsorbent to liquid water and gas, non-outgassing in unruptured state; one of the following:

    a. HBR Closed Cell Backer Rod; Nomaco, Inc.
    b. MasterSeal 920; MBCC Group Master Builders Solutions (formally BASF).
    c. Mile High Foam; Backer Rod Mfg., Inc.

2. Type B: Bi-cellular reticulated, polymeric foam material with a surface skin, nonoutgassing, with a density of between 1.5-3.0 pcf per ASTM D 1622 and minimum tensile strength of greater than 29-38 psi per ASTM D 1623, and with water absorption less than 0.058 oz./cubic inch per ASTM C 1016; one of the following:

    a. SOFROD; Nomaco, Inc.
    b. MasterSeal 921; MBCC Group Master Builders Solutions (formally BASF).
    c. Titan Foam; Backer Rod Mfg., Inc.

C. Bond-Breaker Tape: Polyethylene, TFE fluorocarbon, or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

D. Weep and Vent Tubes: Clear plastic (PVC) tubing, minimum 1/4 inch inside diameter, and of length as required to extend between exterior face of sealant and open cavity behind.

1. At window and curtain wall systems, where required by system designer, provide gutter termination of tube with preformed nipples suitable for sealing to gutter.

E. Cork Joint Filler: Resilient and nonextruding, ASTM D 1752, Type II.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended, as verified through compatibility and adhesion testing, by joint sealant manufacturer for the substrates indicated to be sealed.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and which will not stain nor mar the finish of surfaces adjacent to joints to which it is applied.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. Silicone Glazing Sealants: Refer to Section 08 80 00 "Glazing."

B. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:

1. Remove foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), existing joint sealants, existing backer rods, existing waterproofing materials, existing water repellent treatments, oil, grease, water, surface dirt, and frost.
2. Clean concrete, masonry, unglazed surfaces of tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form-release agents from concrete.
4. Clean metal, glass, porcelain enamel, glazed surfaces of tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

C. Joint Priming (Elastomeric Sealants Only): Prime joint substrates with primers selected through the preconstruction compatibility and adhesion testing. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

D. Joint Priming (Elastomeric Sealants Only): Prime joint substrates where recommended in writing by joint sealant manufacturer, based on prior testing and experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration beyond bond areas or onto adjoining surfaces.

E. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant and primer smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

1. Silicone Glazing Sealants: Refer to Section 08 80 00 "Glazing" for installation.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

    a. Do not leave gaps between ends of sealant backings. Trim for tight fit around obstructions or elements penetrating the joint.
    b. Do not stretch, twist, puncture, or tear sealant backings.
    c. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry sealant backings.

2. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.
3. Install weeps and vents into joints at the same time sealants are being installed. Unless otherwise shown on the drawings, or directed by the Architect, locate weeps and vents spaced as recommended by the sealant manufacturer and the window and curtain wall fabricator and erector. Do not install weeps and vents at outside building corners. Do not install vents at horizontal joints immediately below shelf angles, sills, and through wall flashings.

D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

1. Apply sealants in the depth shown or, if none is shown, apply in accordance with the manufacturer's recommendations and the following general proportions and limitations:

a. Apply elastomeric sealants in sidewalk, pavement and similar horizontal joints to a depth equal to 75% of the joint width, but not less than 3/8 inch and not more than 3/4 inch.
b. Apply elastomeric sealants, in joints not subject to traffic or other abrasion, to a depth equal to 50% of the joint width, but not less than 1/4 inch and not more than 1/2 inch.
c. Apply non-elastomeric sealants to a depth approximately equal to the joint width.
d. Fill horizontal traffic bearing joints slightly recessed to avoid direct contact with wheel, and pedestrian traffic. Fill horizontal traffic bearing joints with slope grade polyurethane sealants to a depth approximately equal to the joint width.

2. Pour self-leveling sealants to a depth approximately equal to the joint width.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform, beads to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces. Tool exposed surfaces of sealants to the profile shown, or if none is shown, tool slightly concave.

1. Use masking tape to protect adjacent surfaces of recessed tooled joints.
2. Provide a slight wash on horizontal joints where horizontal and vertical surfaces meet.
3. Against rough surfaces or in joints of uneven widths avoid the appearance of excess sealant or compound by locating the compound or sealant well back into joint wherever possible.

F. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply a bead of silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's printed schedule and covering a bonded area of not less than a 3/8 inch. Hold edge of sealant bead inside of masking tape by 1/4 inch.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of horizontal joints before installing vertical joints. Lap vertical joints over horizontal joints. At end of joints, cut silicone extrusion with a razor knife.

G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, to produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant to comply with sealant manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field-test exterior wall joint-sealant adhesion to joint substrates as follows:

1. Perform 10 tests for the first 1000 feet of joint length for each type of exposed exterior wall sealant and joint substrate.
2. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

B. Field adhesion testing of sealants shall take place in the presence of a qualified technical representative of the sealant manufacturer.

1. Test Method: Test joint sealants by hand-pull method described below:

   a. Make knife cuts from one side of joint to the other, followed by two cuts approximately 3 inches long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from cross-cut end of 3 inch piece.
   b. Use fingers to grasp 3 inch piece of sealant between cross-cut end and 1 inch mark; pull firmly at a 90-degree angle to the joint in the direction of side cuts and hold the sealant in this position for 10 seconds; following the 10 second time duration pull sealant at a 180 degree angle parallel to the joint and hold the sealant in this position for 10 seconds. Pull sealant away from joint to the distance recommended by sealant manufacturer for testing adhesion.
   c. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.

2. The sealant manufacturer's qualified technical representative shall record test results, and observations of joint and sealant conditions, in a field adhesion test log.
3. Repair joint sealants pulled from test area as recommended by sealant manufacturer.
4. The sealant manufacturer shall provide written documentation of changes in product and/or application method required to address sealant failure, observe and document retesting as required by the Architect, and provide a written statement of compliance with applicable warranties.

C. Sealants not evidencing adhesive failure from testing will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

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

3.7 JOINT SEALANT SCHEDULE

A. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:

1. Perimeter joints between storefronts, balcony door, aluminum window, metal framing and adjacent materials: Silicone Sealants for Vertical Applications (Non-Sag), Typical Exterior Wall Joints.
2. Control and expansion joints in cast-in-place concrete: Silicone Sealants for Vertical Applications (Non-Sag), Typical Exterior Wall Joints.
3. Joints between tilt-up concrete units: Two Part Polyurethane Sealants for Vertical Applications (Non-Sag), Typical Exterior Wall Joints.
4. Joints between architectural precast concrete units: Silicone Sealants for Vertical Applications (Non-Sag), Typical Exterior Wall Joints.
5. Control and expansion joints in face brick: Silicone Sealants for Vertical Applications (Non-Sag), Typical Exterior Wall Joints.
6. Control and expansion joints in unit masonry: Silicone Sealants for Vertical Applications (Non-Sag), Typical Exterior Wall Joints.
7. Joints in stone cladding: Silicone Sealants for Vertical Applications (Non-Sag), Typical Exterior Wall Joints.
8. Joints in glass unit masonry assemblies: Butt glazing sealant.
9. Joints in exterior insulation and finish systems: Silicone Sealants for Vertical Applications (Non-Sag), Typical Exterior Wall Joints.
10. Joints in Portland cement plaster (stucco) systems: Silicone Sealants for Vertical Applications (Non-Sag), Typical Exterior Wall Joints.
11. Joints between metal panels: Silicone Sealants for Vertical Applications (Non-Sag), Typical Exterior Wall Joints.
12. Joints between glass for structural glazing: Structural Glazing at Exterior Curtain Walls.
13. Joints between different materials listed above: Silicone Sealants for Vertical Applications (Non-Sag), Typical Exterior Wall Joints.
14. Perimeter joints between materials listed above and frames of doors and windows and louvers: Silicone Sealants for Vertical Applications (Non-Sag), Typical Exterior Wall Joints.

B. Exterior joints in the following horizontal traffic surfaces:

1. Control, expansion, and isolation joints in cast-in-place concrete slabs: Two-Part Polyurethane Sealant for Paving Applications.

2. Control and Expansion Joints in paving units, including steps and ramps: Two-Part Polyurethane Sealant for Paving Applications.
3. Control and expansion joints in joints between precast concrete tee flanges and shapes: Two-Part Polyurethane Sealant for Paving Applications.
4. Around perimeters of parking garage and balcony deck drains: Two-Part Polyurethane Sealant for Paving Applications.
5. Joints between different materials listed above: Two-Part Polyurethane Sealant for Paving Applications.

C. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

1. Control and Expansion Joints on Exposed Interior Surfaces of Exterior Walls: Latex sealant.
2. Perimeter Joints of Exterior Openings Where Indicated: Latex sealant.
3. Vertical Control and Expansion Joints in Stone and Tile Surfaces: Latex sealant.
4. Horizontal Control and Expansion Joints in Stone and Tile Flooring Surfaces: Two-Part Polyurethane Sealant for Paving Applications.
5. Vertical Control Joints on Exposed Surfaces of Interior Unit Masonry and Concrete Walls and Partitions: Latex sealant.
6. Joints on Underside of Precast Beams and Planks: Latex sealant.
7. Perimeter Joints between Interior Wall Surfaces and Frames of Interior Doors, Windows, and Elevator Entrances: Latex sealant.
8. Perimeter Joints between Scalloped, Bent, or Warped Interior Wallboard Surfaces and Straight Trim: Latex Sealant.
9. Joints between Plumbing Fixtures and Adjoining Walls, Floors, and Counters: Mildew resistant silicone sealant.
10. Joints between Glass, and between Glass and Adjacent Substrates: Butt glazing sealant.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes

1. Hollow metal doors and frames.
2. The integration of a security system into the hollow metal door and frame work is required. The Contractor shall be responsible for the total and complete coordination of the security system components into the Work.

B. Knockdown metal doors frames specified in this Section are limited to Tenant Allowance Work interior doors only. Refer to Section 01 21 00 "Allowances."

1.2 ACTION SUBMITTALS

A. Product Data: Submit product data for each product indicated. Include material descriptions, core descriptions, label compliance, sound and fire-resistance ratings, and finishes for each type of door and frame specified.

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. Shop Drawings: Submit door and frame schedule using same reference designations indicated on Drawings. Include opening size(s), handing of doors, frame throat dimensions, details of each frame type, elevations of door design types, details of construction, location and installation requirements of door hardware and reinforcements, hardware group numbers, details of joints and connections, fire label requirements including fire rating time duration, maximum temperature rise requirements, and smoke label requirements.

1. Indicate routing of electrical conduit and dimensions and locations of cutouts in doors and frames to accept electric hardware devices.

D. Construction Samples: Submit approximately 18 by 24 inches, representing the required construction of doors and frames for Project.

1. Doors: Show vertical-edge, top, and bottom construction; insulation; face stiffeners; and hinge and other applied hardware reinforcement. Include louver section and glazing stops if applicable.
2. Welded Frames: Show profile, welded corner joint, welded hinge reinforcement, dust-cover boxes, floor and wall anchors, stops, and silencers. Include panel and louver sections and glazing stops if applicable.

1.3 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

1.4 QUALITY ASSURANCE

A. Hollow Metal Door and Frame Standard: Comply with the applicable provisions and recommendations of the following publications by Hollow Metal Manufacturers Association (HMMA) Div. of National Association of Architectural Metal Manufacturers (NAAMM), unless more stringent requirements are indicated in the Contract Documents:

1. HMMA "Hollow Metal Manual."
2. HMMA 861 "Guide Specifications for Commercial Hollow Metal Doors and Frames."

B. Manufacturer Qualifications: A firm experienced in manufacturing hollow metal doors and frames similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palleted, wrapped, or crated to provide protection during transit and Project site storage.

B. Inspect doors and frames, on delivery, for damage. Tool marks, rust, blemishes, and other damage on exposed surfaces will not be acceptable. Remove and replace damaged items as directed by Architect. Store doors and frames at building site in a dry location, off the ground, and in such a manner as to prevent deterioration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermally Rated Door Assemblies:Design, fabricate and install exterior door assemblies with the assembly U-factor maximum to comply with ASHRAE 90.1 and the IECC for the project specific geographic location of the building project when tested according to NFRC 100 (ASTM C 518).

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide doors and frames by one of the following:

1. Hollow Metal Doors and Frames:

    a. Ceco Door Products; an Assa Abloy Group Company.
    b. Curries Company; an Assa Abloy Group Company.
    c. Steelcraft; an Allegion PLC Company.

2.3 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A 1011/A 1011M, CS (commercial steel), Type B, free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheets: ASTM A 1008/A 1008M, CS (commercial steel), Type B; free from scale, pitting, coil breaks, surface blemishes, buckles, waves, or other defects, exposed (matte) dull finish, suitable for exposed applications.

C. Metallic-Coated Steel Sheets: ASTM A 653/A 653M, CS (commercial steel), Type B; with G60 zinc (galvanized) or A60 zinc-iron-alloy (galvannealed) coating, mill phosphatized.

D. Inserts, Bolts, and Fasteners: Galvanized or cadmium plated steel.

1. Expansion Bolts and Shields: FS FF-S-325, Group III, Type 1 or 2.
2. Machine Screws: FS FF-S-92, carbon steel, Type III cross recessed, design I or II recess, style 2C flat head.

E. Filler: Sound deadening and heat retarding mineral fiber insulating material.

F. Glass and Glazing: Refer to Section 08 80 00 "Glazing."

G. Hardware: Refer to Section 08 71 00 "Door Hardware."

2.4 DOORS

A. General: Provide flush-design doors, 1-3/4 inches thick, of seamless hollow construction, unless otherwise indicated. Construct doors with sheets joined at their vertical edges by continuous welding the full height of the door, or joined at vertical edges by 1 inch spot welds 6 inches on center, or intermittently welded seams. Voids between spot and intermediate welds shall be epoxy edge filled. Grind and finish all welds and edge fills flush to result in invisible seams on the door faces or vertical door edges.

1. Visible joints or seams around glazed or louvered panel inserts are permitted.
2. For single-acting swing doors, bevel both vertical edges 1/8 inch in 2 inches.
3. For double-acting swing doors, round vertical edges with 2-1/8-inch radius.

B. Interior Door Core Construction: Doors shall be stiffened by continuous vertically formed steel sections which, upon assembly, shall span the full thickness of the interior space between door faces. These stiffeners shall be [20 gauge] [22 gauge] not more than 6 inches apart and spot welded to face sheets a maximum of 5 inches o.c. Place filler between stiffeners for full height of door.

C. Exterior Door Core Construction: Subject to compliance with performance requirements, provide either polystyrene or polyurethane cores.

D. Astragals: As required by NFPA 80 to provide fire ratings indicated.

E. Top and Bottom Channels: Spot weld metal channel not less than thickness of face sheet to face sheets not more than 6 inches o.c.

1. Reinforce tops and bottoms of doors with inverted horizontal channels of same material as face sheet so flanges of channels are even with bottom and top edges of face sheets.
2. For exterior doors, close top edge with metallic-coated steel closing channel of same material, so webs of channels are flush with top door edges. Weld inverted steel channels to both face sheets or form integrally with edge construction of door.

F. Hardware Reinforcement: Fabricate reinforcing from the same material as door to comply with the following. Offset reinforcement so that faces of mortised hardware items are flush with door surfaces.

1. Hinges and Pivots: 7 gauge thick by 1-1/2 inches wide by 9 inches.
2. Lock Front, Strike, and Flushbolt Reinforcements: 12 gauge thick by size as required by hardware manufacturer.
3. Lock Reinforcement Units: 14 gauge thick by size as required by hardware manufacturer.
4. Closer Reinforcements: 12 gauge thick one-piece channel by size as required by hardware manufacturer.
5. Other Hardware Reinforcements: As required for adequate strength and anchorage.
6. In lieu of reinforcement specified, hardware manufacturer's recommended reinforcing units may be used.

7. Exit Device Reinforcements: 12 gauge thick by 10 inches high by 4 inches wide centered on exit device case body, unless otherwise recommended by exit device manufacturer.

G. Electrical Requirements: Make provisions for installation of electrical items specified elsewhere; arrange so wiring can be readily removed and replaced.

1. Provide all cutouts and reinforcements required for hollow metal doors to accept security system components.
2. Doors with Electric Hinges and Pivots: Provide with metal conduit or raceway to permit wiring from electric hinge or pivot to other electric door hardware.

a. Hinge Location: Center for doors less than 90 inches tall or second hinge from door bottom for doors greater than 90 inches; top or bottom electric hinge locations shall not be permitted.

H. Interior Hollow Metal Doors:

1. Typical Interior Doors: Flush design with 16 gauge thick cold-rolled stretcher-leveled steel face sheets and other metal components from hot- or cold-rolled steel sheets.
2. Extra Heavy Use Doors: Flush design with 14 gauge thick cold-rolled, stretcher-leveled steel face sheets and other metal components from hot- or cold-rolled steel sheets. Provide only where indicated.

I. Exterior Hollow Metal Doors: Flush design with 14 gaugethick metallic-coated stretcher leveled steel face sheets, unless heavier gage is required to comply with the performance requirements, and other metal components from metallic coated steel sheets. Provide weep-hole openings in bottom of doors to permit entrapped moisture to escape.

2.5 FULL GLAZED STILE AND RAIL DOORS

A. Form doors with stiles and rails of continuous steel channels, fabricated from not lighter than 16 gauge thick cold rolled steel, welded together to form a rigid tubular frame. Door corners shall be mitered and butted. Mitered joints shall be internally reinforced, welded, and ground smooth such that no miter joints appear on the door faces. Intermediate rails shall be butted and internally welded to door stiles. Continuously weld all joints for the full height of the door, with no visible seams on their faces, horizontal, or vertical edges, and all welds ground and finished flush.

2.6 DUTCH DOORS

A. Fabricate as specified for flush doors. Provide shelf with boxed edges and closed ends; fabricate from 16 gauge thick cold rolled steel sheet. Support shelf on door manufacturer's standard steel brackets, unless otherwise indicated.

2.7 PANELS

A. Provide panels of same materials, construction, and finish as specified for doors.

2.8 WELDED FRAMES

A. Fabricate hollow metal frames, formed to profiles indicated, with full 5/8 inch stops, and of the following minimum thicknesses.

1. For exterior use, form frames from 14 gauge thick, metallic-coated steel sheets.
2. For interior use, form frames from cold- rolled steel sheet of the following thicknesses:

    a. Openings up to and Including 48 Inches Wide: 16 gauge.
    b. Openings More Than 48 Inches Wide: 14 gauge.

3. Frame heads at all masonry openings shall be formed to extend to the lowest CMU horizontal mortar joint.

B. Provide frames either saw mitered and full (continuously) profile welded, or machine mitered and full profile welded, on back side at frame corners and stops with edges straight and true. Grind welds smooth and flush on exposed surfaces.

C. Hardware Reinforcement: Fabricate reinforcements from same material as frame to comply with the following. Offset reinforcement so that faces of mortised hardware items are flush with surface of the frame.

1. Hinges and Pivots: 7 gauge thick by 1-1/4 inches wide by 10 inches.
2. Strike, Surface Mounted Hold Open Arms, and Flushbolt Reinforcements: 12 gauge thick by size as required by hardware manufacturer.
3. Closer Reinforcements: 12 gauge thick one piece channel by size as required by hardware manufacturer.
4. Other Hardware Reinforcements: As required for adequate strength and anchorage.

D. Electrical Requirements: Make provisions for installation of electrical items specified elsewhere; arrange so wiring can be readily removed and replaced.

1. Provide all cutouts and reinforcements required for steel frames to accept security system components.
2. Frames with Electric Hinges and Pivots: Provide welded on UL listed back boxes with metal conduit or raceway to permit wiring from electric hinge or pivot to other electric door hardware.

    a. Hinge Location: Center for doors less than 90 inches tall or second hinge from door bottom for doors greater than 90 inches; top or bottom electric hinge locations shall not be permitted.

E. Mullions and Transom Bars for Sidelights, Transoms, and Borrowed Light Frames: Provide closed or tubular mullions and transom bars where indicated. Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between frame members with concealed clip angles or sleeves of same metal and thickness as frame.

F. Jamb Anchors: Locate jamb anchors above hinges and directly opposite on strike jamb as required to secure frames to adjacent construction. At metal stud partitions locate the additional jamb anchor below the top hinge.

1. Metal-Stud Partitions: Metal channel stud zee anchor sized to match stud width, welded to back of frames, formed of same material and gauge thickness as frame. Unless closer spacing is required to meet the performance requirements provide at least the number of anchors for each jamb according to the following heights:

a. Three anchors per jamb up to 60 inches in height.
b. Four anchors per jamb from 60 to 90 inches in height.
c. Five anchors per jamb from 90 to 96 inches in height.
d. One additional anchor per jamb for each 24 inches or fraction thereof more than 96 inches in height.

G. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, formed of same material as frame, 12 gauge thick, and punched with two holes to receive two 0.375 inch fasteners. Where floor fill or setting beds occur support frame by adjustable floor anchors bolted to the structural substrate. Terminate bottom of frames at finish floor surface. Weld floor anchors to frames with at least 4 spot welds per anchor.

H. Head Strut Supports: Provide 3/8-by-2-inch vertical steel struts extending from top of frame at each jamb to supporting construction above. Bend top of struts to provide flush contact for securing to supporting construction above by bolting, welding, or other suitable anchorage. Provide adjustable wedged or bolted anchorage to frame jamb members to permit height adjustment during installation. Adapt jamb anchors at struts to permit adjustment.

I. Head Reinforcement: For frames more than 48 inches wide in masonry wall openings, provide continuous steel channel or angle stiffener, 12 gauge thick for full width of opening, welded to back of frame at head. Head reinforcements shall not be used as a lintel or load-bearing member for masonry.

J. Spreader Bars: Provide removable spreader bar across bottom of frames to serve as bracing during shipment and handling and to hold frames in proper position do not tack weld bars to frames.

K. Door Silencer Holes: Drill strike jamb stop to receive three silencers on single door frames and for two silencers on double door frames. Insert plastic plugs in holes to keep holes clear during installation.

L. Plaster, Mortar and Grout Guards and Removable Access Plates: Provide minimum 26 gauge thick guards or dust-cover boxes of same material as frame, welded to frame at back of hardware cutouts to close off interior of openings and prevent mortar or other materials from obstructing hardware and hardware fastener installation and hardware operation. Provide removable access plates in the heads of frames to receive overhead concealed door closers.

2.9 LOUVERS

A. Door Louvers: Fabricate louvers and mount flush into doors without overlapping moldings on surface of door face sheets. Provide internal support as recommended by louver manufacturer. Prime paint steel louvers after fabrication.

1. Interior Louvers: Sightproof, stationary type, constructed of inverted V or Y-shaped blades formed of same material as door.

a. Steel: 18 gauge (0.042 inch) thick.

2.10 STOPS AND MOLDINGS

A. Provide continuous stops and moldings around solid, glazed, and louvered panels where indicated.

B. Form fixed stops and moldings integral with frame, on the exterior (non-secured) side of the frame.

C. Provide removable stops and moldings formed of 20 gauge thick steel sheets matching hollow metal frames. Secure with countersunk oval head machine screws spaced uniformly not more than 12 inches o.c. Form corners with butted or mitered hairline joints.

D. Coordinate rabbet width between fixed and removable stops with type of glass or panel and type of installation indicated.

2.11 FABRICATION

A. Fabricate doors and frames rigid, neat in appearance, and free of defects, warp, wave, and buckle. Accurately form metal to sizes and profiles indicated. Accurately machine, file, and fit exposed connections with hairline joints. Weld exposed joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

B. Exposed Fasteners: Provide countersunk flat heads for exposed screws and bolts, unless otherwise indicated.

C. Hardware Preparation: Prepare doors and frames to receive hardware, including cutouts, reinforcement, mortising, drilling, and tapping, according to final hardware schedule and templates provided by hardware supplier. Secure reinforcement by spot welding. Comply with applicable requirements of ANSI/BHMA A156.115 and A156.115W specifications for door and frame preparation for hardware. Factory-reinforce doors and frames to receive surface-applied hardware. Factory drill and tap for surface-applied hardware, except at pushplates and kickplates provide reinforcing only.

1. Locate hardware as indicated on the Drawings or in Section 08 71 00 "Door Hardware" or, if not indicated, according to HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."

2.12 METALLIC-COATED STEEL FINISHES

A. General: Clean, treat and prime surfaces of fabricated steel door and frame work, inside and out, whether exposed or concealed in the construction.

B. Surface Preparation: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Factory Priming for Field-Painted Finish: Apply shop primer immediately after surface preparation and pretreatment. Apply a sufficient number of coats, baked on, to obtain uniformly smooth exposed surfaces. Touch up surfaces having runs, smears, or bare spots.

1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for zinc-coated steel; compatible with substrate and field-applied finish paint system indicated.

2.13 STEEL SHEET FINISHES

A. General: Clean, treat and prime surfaces of fabricated steel door and frame work, inside and out, whether exposed or concealed in the construction.

B. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale, shavings, filings, and rust, if present, complying with SSPC-SP 3, "Power Tool Cleaning."

C. Factory Priming for Field-Painted Finish: Apply shop primer immediately after surface preparation and pretreatment. Apply a sufficient number of coats, baked on, to obtain uniformly smooth exposed surfaces. Touch up surfaces having runs, smears, or bare spots.

1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, corrosion-inhibiting, lead- and chromate-free, universal primer complying with ANSI A250.10 acceptance criteria; compatible with substrate and field-applied finish paint system indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install doors and frames according to the referenced standards, the Architect reviewed shop drawings, and manufacturer's written recommendations and installation instructions.

B. Frames: Install frames where indicated. Extend frame anchorages below fills and finishes. Coordinate the installation of built-in anchors for wall and partition construction as required with other work.
   1. Welded Frames:
      a. Placing Frames: Remove temporary spreader bars prior to installation of the frames. Set frames accurately in position; plumb; align, and brace securely until permanent anchors are set.
         1) At concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage devices. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
         2) Anchor bottom of frames to floors through floor anchors with threaded fasteners.
         3) Field splice only at approved locations indicated on the shop drawings. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.
         4) Remove spreader bars only after frames are properly set and secured.
   2. At fire-rated openings, install frames according to NFPA 80.

C. Doors:
   1. Non-Fire Rated Doors: Fit non-fire-rated doors accurately in their respective frames, with the following clearances:
      a. Jambs and Head: 3/32 inch.
      b. Meeting Edges, Pairs of Doors: 1/8 inch.
      c. Bottom: 3/8 inch, if no threshold or carpet.
      d. Bottom: 1/8 inch, at threshold or carpet.

D. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat or oval head machine screws spaced uniformly not more than 9 inches2 inches

E. Apply hardware in accordance with hardware manufacturer's instructions and Section 08 71 00 "Door Hardware." Drill and tap for machine screws as required. Do not use self tapping sheet metal screws. Adjust door installation to provide uniform clearance at head and jambs, and to contact stops uniformly. Adjust hardware items just prior to final inspection. Leave work in complete and proper operating condition.

1. Exterior Hollow Metal Door Assemblies: Install hardware in accordance with the applicable provisions of acceptance indicated under the door and frame manufacturer's Notice of Acceptance (NOA) as published by Miami-Dade County, Florida or Florida Product Approval as published by current Florida Building Code.

3.2 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items just before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames that are warped, bowed, or otherwise unacceptable.

B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

1. Finish Painting: Refer to Section 09 91 23 "Interior Painting" and Section 09 91 13 "Exterior Painting."

C. Remove and replace defective work, including doors or frames that are warped, bowed, or otherwise defective.

D. Institute protective measures required throughout the remainder of the construction period to ensure that the hollow metal doors and frames will be without damage or deterioration, at time of Substantial Completion.

END OF SECTION 08 11 13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes solid core flush wood doors.

1. The integration of a security system into the flush wood door work is required. The Contractor shall be responsible for the total and complete coordination of the security system components into the Work.

1.2 ACTION SUBMITTALS

A. Product Data: Submit product data for each type of door required. Include factory-finishing specifications.

1. Submit laboratory test report results of hinge loading, cycle/slam, stile edge screw withdrawals, and stile edge split resistance for fire rated doors.

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. Shop Drawings: Submit shop drawings indicating location, size, thickness, and hand of each door; elevation of each kind of door; construction details not covered in the product data; location and extent of hardware blocking; clearances, special beveling, and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware of factory machined doors.
2. Indicate dimensions and locations of cutouts.
3. Indicate fire label requirements including fire rating time duration, maximum temperature rise requirements, and smoke label requirements.
4. Indicate routing of electrical conduit and dimensions and locations of cutouts in wood doors to accept electric hardware devices.

D. Samples: Cut away corner section of each door type approximately 8 by 10 inches demonstrating door construction, face veneer and finish.

1.3 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.

2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

B. Certificate of Compliance for Fire Rated Doors: Provide copies of testing agency's Certificate of Compliance for all fire rated door assemblies, all smoke and draft control door assemblies, and all temperature rise rated door assemblies.

1.4 QUALITY ASSURANCE

A. Quality Standard: Comply with the applicable provisions and recommendations of AWI's "Architectural Woodwork Quality Standards Illustrated, 8th Edition, Version 2.0, Section 1300" where standards and specifications conflict the more stringent shall be required.

B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect wood doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in heavy duty cardboard cartons or poly bags.

C. Handle wood doors with clean gloves. Lift and carry wood doors when moving them around the site, do not drag wood doors across one another.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until wet work , such as masonry, concrete, stone, tile, terrazzo, plastering, wallboard joint treatment, is complete and dried, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period. Do not expose doors to sudden changes in temperature such as forced heat used to dry out the site.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship for the life of the original installation of the door. A representative of the door manufacturer shall inspect the installed doors and shall note on the warranty that no provisions of the warranty have been nullified in the manufacture and/or installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Manufacturers: Subject to compliance to requirements, provide products by one of the following:

1. Aspiro Series/Marshfield-Algoma, Masonite Architectural.
2. Heritage Collection; VT Industries.

2.2 DOOR CONSTRUCTION

A. General:

1. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain added formaldehyde.
2. Regional Materials: Wood doors shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
3. Certified Wood: Wood doors shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001 and FSC STD-40-004.
4. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
5. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

B. Doors for Transparent Finish:

1. Grade: Premium, with Grade AA faces.

2. Face Veneer Species and Cut: Matching Architect's samples indicated in Finish Schedule on Drawings.
3. Match between Veneer Leaves: Book match matching Architect's samples.
4. Assembly of Veneer Leaves on Door Faces: Center balance match.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Thickness: 1-3/4 inch unless otherwise indicated.
7. Materials:

    a. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
    b. Blocking: 5-1/2 inch wide minimum top-rail blocking at doors with closers and bottom rail blocking at doors with kickplates consisting of minimum 1/2 inch wide single length structural composite lumber (SCL) outer band and single length SCL inner band.
    c. Vertical Edges: 1-3/8 inch wide minimum prior to fitting, 2 ply laminated wood construction consisting of a single piece hardwood outer band, without fingerjoints, and an inner band of SCL. Outer band to match face veneer for transparent finished veneered-faced doors. Trim non-rated door width equally on both jamb edges.
    d. Crossbanding: Minimum 1/16 inch thick, low density hardwood, composite, or HDF (high density fiberboard).

8. Construction: AWI Section 1300, PC-5 ME. Stiles, rails, and blocking bonded to core then entire unit abrasive planed before veneering. Crossbanding materials shall extend full width of door with grain running horizontally, tapeless spliced without voids or show through (telegraphing), and directly glued to core and blocking. Sand cross banding before application of face veneer. Face veneer shall extend full height of door with grain running vertically, tapeless spliced without voids or show through (telegraphing), and directly glued to cross band. Glue lines between face veneer, crossbanding, and blocking shall be of a type to comply with the specified warranty using the hot plate process.

C. Wood Beads for Light Openings in Wood Doors: Manufacturer's standard flush designed, solid wood, rectangular shaped, back beveled or quirked, beads matching veneer species of door faces. Include glazing compounds or tapes sized for back bevel or quirk provided. Include finish nails for removable stops sized in accordance with wood door manufacturer's recommendations.

2.3 FABRICATION

A. Fabricate doors in sizes indicated for Project-site fitting.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3 unless otherwise indicated to match existing frame hardware preparations. Comply with final hardware schedules, door frame Shop Drawings, AWI Section 1300-G-20, BHMA A156.115-W standards, and hardware templates.

1. Coordinate measurements of hardware mortises in frames to verify dimensions and alignment before factory machining.

C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required. Install light beads with fasteners spaced for opening size and fire rating indicated. Install wood bead moldings with finish nails and countersink without striking bead. Fill countersunk heads with putty matching wood bead color.

2.4 FACTORY FINISHING

A. General: Finish doors at factory that are indicated to receive transparent finish.

B. Grade: Premium.

C. Finish: Manufacturer's standard finish with performance meeting or exceeding either AWI System TR-4 conversion varnish or AWI System TR-6 catalyzed polyurethane.

D. Staining: Prepare door faces, stiles, rails, and cutouts, with toners, or stains, prior to the application of finish to match Architect's sample.

E. Effect and Sheen: Match Architect's sample in indicated in Finish Schedule on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: Apply hardware to new doors in accordance with hardware manufacturer's instructions and Section 08 71 00 "Door Hardware." For particleboard core doors drill pilot holes of proper size for installing hinge screws. Adjust hardware items just prior to final inspection. Leave work in complete and proper operating condition.

1. Factory wrapping shall be maintained on new doors during construction period, and all hardware shall be installed by cutting the factory wrapping at the mounting location of the hardware item.

B. General Door Installation Standards: Install doors in locations indicated to comply with manufacturer's written instructions, referenced quality standard, and as indicated. Where standards conflict the more stringent shall apply.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; and to contact stops uniformly, do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Field cutting, fitting or trimming, shall be executed in a workmanlike manner. Machine doors for hardware. Seal cut and trimmed surfaces immediately after fitting and machining using clear varnish or sealer.

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

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

3.2 ADJUSTING AND PROTECTION

A. Rehang or replace doors that do not swing or operate freely.

B. Protection: Protect wood doors to ensure that the wood door work will be without damage or deterioration at the time of Substantial Completion.

1. Refinish or replace wood doors damaged during installation. Replace any new wood doors that are warped, twisted, demonstrate core show through, are not true in plane, or cannot be refinished to the satisfaction of the Architect.

END OF SECTION 08 14 16

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes aluminum-framed entrances and storefronts.

1. Security system components may be incorporated into the door and frame openings of all aluminum-framed entrances and storefronts at the Owner's option. Cooperate with the Owner's security system contractors if the Owner chooses to incorporate security system components during the course of the Work.
2. Single Subcontract Responsibilities: Refer to Section 08 44 13 "Glazed Aluminum Curtain Walls" for the requirements of single subcontract responsibilities for aluminum-framed entrances and storefronts.

B. Section includes aluminum-framed entrances and storefronts. The aluminum-framed entrance and storefront work includes the following:

1. Aluminum swing entrance doors and framing, including hardware, stripping and thresholds.
2. Aluminum trim, flashings, and similar items in conjunction with aluminum-framed entrance and storefronts.
3. Painting and coating in conjunction with the above aluminum items.
4. Internal steel and aluminum reinforcements for aluminum-framed entrances and storefronts.
5. Internal and perimeter sealing, joint fillers, weeps, vents and gasketing systems for aluminum-framed entrances and storefronts.
6. Anchors, shims, fasteners, inserts, expansion devices, accessories, support brackets and attachments for aluminum-framed entrances and storefronts.
7. Glass and glazing for aluminum-framed entrances and storefronts.

1.2 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for each aluminum-framed entrance and storefront product specified.

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. Shop Drawings: Submit shop drawings showing scaled elevations, plans, and sections of the aluminum entrance and storefront work. Full-scale sections shall be prepared and submitted for details of the assemblies that cannot be shown in the elevations or sections. Include with shop drawings metal thickness of all metal components, glass thicknesses, metal finishes, location and installation requirements of door hardware and reinforcements, and all other pertinent information as necessary or requested by the Architect to indicate compliance with the Contract Documents. Details of field connections, anchorage, and their relationship to the work of others shall be clearly indicated for the coordination of the work by other building trades. Details of fastening and sealing methods and product joinery shall be shown to ensure proper performance of the field installation. No work shall be fabricated until shop drawings for that work have been approved by Architect for fabrication.

1. Hardware Schedule: Organize schedule into sets based on hardware specified. Include name of item and manufacturer, and complete designation of every item required for each entrance door.
2. Indicate routing of electrical conduit and dimensions and locations of cutouts in doors and frames to accept electric hardware devices.
3. Show direction of coil coating applied to metal panel faces.

D. Samples: Submit samples of the following before any work is fabricated:

1. Three paired sets of samples for each exposed metal finish required. Sample finishes shall be on the specified alloy, temper, and thickness of metal required for the work. Where finishes involve color and texture variations, include sample sets showing the full range of variations expected. Furnish samples in either 12 inch lengths of patch fittings, rails, or 12 inch squares of sheet.

1.3 INFORMATIONAL SUBMITTALS

A. Structural Calculations: Submit, for information only, copies of structural calculations indicating complete compliance with the specified performance requirements. Calculations shall be prepared, signed and sealed by a Professional Engineer registered in the state wherein the work is to be erected.

B. Field Test Reports: Submit field testing reports.

C. Product Test Reports: Submit certified product test reports based on tests performed by an AAMA Accredited Laboratory clearly describing in written form, and in shop drawing form, compliance of each aluminum-framed entrance and storefront assembly (each swinging and sliding door) with requirements indicated based on comprehensive testing.

D. Research/Evaluation Reports: Submit research/evaluation reports (NOA's) from the Miami-Dade County Florida, Building Code Compliance Office, Product Control Division that the selected aluminum framed entrance and storefront assemblies complies with the performance requirements and is approved for use in the High Velocity Hurricane Zone of the Florida Building Code.

1. The report shall clearly indicate the Notice of Approval (NOA) for each selected aluminum framed entrance and storefront assembly being installed for the project.

E. Pre-Construction Sealant Compatibility and Adhesion Testing: Submit test results.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Instructions: Submit copies of an assembled and bound maintenance manual, describing the devices and procedures to be followed in cleaning, adjusting, and maintaining the aluminum-framed entrance and storefront work. Include information for maintaining operable doors, operating hardware, and replacing weather stripping.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Refer to Section 08 44 13 "Glazed Aluminum Curtain Walls."

B. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Prior to the start of the aluminum-frame entrance and storefront work, and at the Contractor's direction, meet at the site and review the installation procedures and coordination with other work. Meeting shall include Contractor, Owner, Architect, aluminum-framed entrance and storefront installer, sealant installer, as well as any other subcontractors or material technical service representatives whose work, or products, must be coordinated with the aluminum-framed entrance and storefront work.

1.6 IDENTIFICATION, DELIVERY, STORAGE, AND HANDLING

A. General: Refer to Section 08 44 13 "Glazed Aluminum Curtain Walls."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of supporting structure by field measurements before fabrication so that the entrance and storefront work will be accurately designed, fabricated and fitted to the structure. Indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work. Use Contractor's lines and benchmarks as a basis for measurements.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating entrance and storefront work without field measurements. Coordinate supporting structure construction to ensure actual dimensions correspond to established dimensions.

B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to, power supplies, fire alarm system and detection devices, access control system, security system, building control system.

1.8 WARRANTY

A. General: Refer to Section 08 44 13 "Glazed Aluminum Curtain Walls."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer Qualifications: The drawings and specifications are based on YKK YES 45 TU, Front Set systems. . Award the fabrication of aluminum framed entrances and storefront components to a single firm specializing in the fabrication of aluminum framed entrances and storefront components who has successfully produced work similar in design and extent to that required for the project, in not less than three projects of similar scope to the satisfaction of the Architect, and whose work has resulted in construction with a record of successful in-service performance for a period of 5 years. The fabricator shall have sufficient production capacity, have organized quality control and testing procedures, and published written and illustrated installation manuals, to produce and properly install the aluminum framed entrances and storefront assemblies required without causing delay in progress of the Work. Other manufacturers capable of producing aluminum framed entrances and storefront systems meeting the performance requirements include the following:

1. EFCO Corporation division of Pella.
2. Wausau Window and Window Wall Systems.
3. Graham Architectural Products Corp.

B. Source Limitations: Obtain aluminum framed entrances and storefronts from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Refer to Section 08 44 13 "Glazed Aluminum Curtain Walls" for performance requirements, fabrication and erection standards; in addition provide the following:

1. Design and fabricate aluminum-framed entrances to withstand the operating loads which result from heavy traffic conditions using the specified hardware, without measurable permanent deflection. Limit elastic deflections so as to provide the normal degree of rigidity required to avoid glass breakage, air leaks and other objectionable results of excessive flexibility. Provide weatherstripping at stiles, sill and head rails of door leaves, to minimize air, water and sound leaks.

B. Design Modifications:

1. Submit design modifications necessary to meet the performance requirements and field coordination.
2. Variations in details or materials shall not adversely affect the appearance, durability or strength of components.
3. Maintain the general design concept without altering size of members, profiles and alignment.

2.3 MATERIALS

A. Aluminum: Refer to Section 08 44 13 "Glazed Aluminum Curtain Walls."

B. Carbon Steel: For carbon steel components required to join, reinforce or support the assembly of aluminum components provide carbon steel conforming to ASTM A 36/A 36M for structural shapes, plates, and bars; ASTM A 1008/A 1008M for cold-rolled sheet and strip; or ASTM A 1011/A 1011M for hot-rolled sheet and strip.

1. Refer to Section 05 50 00, Metal Fabrications, for carbon steel framing, embedments, anchors, and welding that is not primary building structure nor furnished by the entrance and storefront fabricator but is required to transmit live and deadloads from the entrance and storefront framing to the primary building structure.

C. Glass and Glazing Materials: As specified in Section 08 80 00 "Glazing."

D. Anchors and Fasteners:

1. Material:

a. Wet Zones: Series 300 stainless steel.
b. Dry Zones: Carbon steel complying with either ASTM F 3125 or SAE Grade 5.

2. Anchor and Fastener Metal Alloy Types, Designations and Standards: Alloys as selected by fabricator to prevent corrosion resistance with the components fastened. Do not use self-drilling, self-tapping type fasteners.
3. Do not use exposed anchors and fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.
4. Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.

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

F. Concealed Flashing: Dead-soft, 0.018 inch thick stainless steel, complying with ASTM A 666, Type 304.

G. Weather Stripping:

1. Compressible Weatherstripping: Compressible weatherstripping gaskets fabricated from extruded multi-fingered PVC, silicone or neoprene, replaceable, held in adjustable depth extruded metal strips to be mortised into edge of door panels for minimum exposure, metal finish to match finish of door.

2.4 SEALING MATERIALS

A. Concealed Sealing Materials: All sealing materials concealed within the entrances and storefronts (i.e. glass pockets, end dams, fastener heads, and internal gutters) shall be silicone, compatible with and adherent to each material it will be in contact with, as recommended by the manufacturer to fulfill performance requirements.

1. Sealant shall have a VOC content of 250 g/L or less.

B. Exposed Sealing Materials: All sealing materials exposed at entrance and storefront perimeter joints in contact with adjacent cladding materials: Silicone, refer to Section 07 92 00 "Joint Sealants."

2.5 FABRICATION

A. General: Fabricate the entrances and storefronts to the designs, shapes, and sizes shown using the materials specified and shown to produce assemblies that meet or exceed the performance requirements. To the greatest extent possible, complete fabrication, assembly, finishing, hardware applications and other work before shipment to Project site.

1. Metal Wall Thickness: Provide shapes as shown and as required to suit the performance requirements but with wall thickness of not less than 1/8 inch.
2. Door Stile and Rail Dimensions:

    a. Bottomrails: Provide minimum 10 inch high one piece bottomrail unless otherwise indicated on the Drawings.
    b. Stiles and Top Rail Dimensions: Ultra Narrow stile; less than 1-1/8 inches wide Thin stile; less than 1-3/4 inches wide
    c. Door Thickness: 1-3/4 inch.
    d. Fabricate all doors and frames to accommodate the swing direction shown.

3. Provide extruded aluminum entrance door inserts at door frames designed with bosses sized to receive selected door gasket.

B. Glazing Stops and Gaskets: Provide continuous interior glazing stops with concealed fasteners for all doors and frames. Provide stops with hairline joints at corners. Provide stops with beveled, not square, shouldered profile unless otherwise shown.

C. Glass Components: Provide holes and cutouts in glass to receive hardware and accessories before tempering glass. Drill, countersink, and chamfer holes using tooling, materials and methods which are selected and applied to prevent spalling of the cut glass surfaces at holes and cutouts. The internal surface of holes and cutouts shall be smooth with minimal roughness from drilling operations. Do not cut, drill, or make other alterations to glass after tempering.
   1. Fully temper glass using horizontal (roller-hearth) process and fabricate so, when installed, roll-wave distortion is parallel with bottom edge of door or lite.
   2. Heat Soaking: After tempering, expose 100% of all fabricated glass units to European Standard EN14179 heat soaking process to reduce the potential for inclusion related glass breakage.
   3. Factory assemble components and factory install hardware to greatest extent possible.

D. Metal Components: Doors and frames shall be cut, reinforced, drilled and tapped in strict accordance with the printed door hardware manufacturer's templates and instructions. Provide solid stainless steel hardware reinforcements, securely fastened to doors and frames where door hardware is to be attached.

   1. Security system components may be incorporated into the door and frame openings of all entrance doors and frames. Provide all cutouts required by the Owner's security system vendor and all prewiring for vendor provided security system devices. Wherever storefront and entrance framing components are to receive wiring provide unobstructed clear paths free of burrs and sharp objects with pull strings to facilitate wiring.

E. Joints in Metal Work: All exposed work shall be carefully fitted and matched to produce continuity of line and design, with all joints, being accurately fitted for hairline contact and rigidly secured. Where additional rigidity or strength is required to satisfy the performance requirements reinforce entrance components with aluminum or carbon steel shapes, bars, and plates.

F. Shop Assembly: As far as practicable, all fitting and assembly work shall be done in a fabrication shop.

   1. For exterior entrances, provide weepholes and internal water passages in the glazing framing recesses as recommended by the respective glass and framing manufacturers to conduct infiltrating water to the exterior. Provide weep baffles secured to inside of frame behind weepholes.

G. Exposed Fasteners: Not permitted.

H. Protection of Metals: Wherever dissimilar metals are in contact, except in the case of aluminum in contact with galvanized steel, zinc, separate such surfaces with a coating of zinc rich primer, bituminous paint, or separation gaskets as the condition requires. Wherever aluminum comes in contact with concrete surfaces separate such surfaces with a coating of zinc rich primer, bituminous paint, or separation gaskets as the condition requires.

2.6 ALUMINUM FINISHES

A. General: As specified in Section 08 44 13 "Glazed Aluminum Curtain Walls."

B. Finish Application:

1. Apply high performance organic coatings to all exposed exterior surfaces of storefront and entrance components. Apply thermosetting acrylic enamel coatings to all exposed interior surfaces of storefront and entrance components.

C. Appearance of Finished Work: During production, maintain large size color range samples for use in comparing against production material. Variations in appearance of abutting or adjacent pieces are acceptable if they are within the range of approved samples. Noticeable variations in the same piece are not acceptable.

D. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

E. High-Performance Organic Coating Finish: AA-C12C42R1x and the following:

1. Polyvinylidene fluoride finish coating containing not less than 70 percent of "Kynar 500" or "Hylar 5000" fluorocarbon resin specially formulated for spray application to extrusions and preformed aluminum metal shapes. Remove die markings, scratches, abrasions, dents and other blemishes before applying finish. Coating films shall be uniform and visibly free from flow lines, streaks, blisters, sags or other surface imperfections in the dry-film state on all surfaces.

a. Metal Preparation and Pretreatment: Pretreatment of aluminum surface and application of the finish shall be performed under specifications issued by the licensed formulator to approved applicator and the following as a minimum:

1) The products used to form the chemical conversion coating on aluminum extrusions shall conform to ASTM D 1730, Type B, Method 5 (Amorphous Chromium Phosphate Treatment) or Method 7 (Amorphous Chromate Treatment), or Trivalent Chrome Treatment.
2) The coating weight of the chemical conversion coating shall be a minimum of 40 mg. per sq. ft. on exposed surfaces as specified in ASTM B 449, Section 6, Class I. Processing shall conform to that specified in ASTM B 449, Section 5.

b. Thickness:

1) Fluoropolymer 2-Coat Coating System: Minimum 1.2 mil total dry film thickness (0.25 mil primer +/- 0.05 mil and 1.0 mil topcoat).

c. Coating Performance Criteria: Meets or exceeding AAMA 2605.

d. Color: One custom color to be determined by Architect.
e. Manufacturer, Coating System:

1) Two Coat, Opaque System; one of the following:

a) PPG Paints; Duranar.
b) Sherwiin-Williams (formally Valspar, Inc.); Fluropon Standard.

2.7 COATINGS FOR CONCEALED METAL SURFACES

A. General: The following protective coatings shall be applied to surfaces of metals which are to be concealed in the construction:

1. Coating for Carbon Steel: Hot dip galvanized, complying with ASTM A 123.
2. Coating for Aluminum, Carbon Steel, and Bronze: Where aluminum or carbon steel surfaces are to be in contact with each other or in contact with dissimilar materials such as masonry or concrete, and where hot dip galvanizing of carbon steel is incompatible with component parts because of galvanic action or component fabrication tolerances provide one of the following:

a. Bituminous Paint: Cold-applied, non-sagging, bituminous paint complying with ASTM D 1187. Apply in two coats for an overall minimum dry film thickness of 25 mils.
b. Zinc Rich Primer: Organic zinc-rich primer, complying with SSPC-Paint 20.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate entrance and storefront work with the work of other Sections and provide items to be placed during the installation of other work at the proper time to avoid delays in the work.

B. Templates and Diagrams: Furnish templates, diagrams, and other data to fabricators and installers of related work, as necessary for coordinating entrance and storefront installation.

C. Place such items, including concealed overhead framing, accurately in relation to the final location of entrance and storefront components.

3.2 EXAMINATION

A. Examine the substrates, adjoining construction, and conditions under which the Work is to be installed. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Before beginning installation of the entrance and storefront work examine all parts of the existing building structural frame and the existing building cladding indicated to support the entrance and storefront work. Ensure that the existing swing door thresholds, existing swing doors, swing door framing and subframes have been completely removed with all projecting anchors cut off flush. Notify Contractor in writing, of any dimensions, or conditions, found which will prevent the proper execution of the entrance and storefront work, including specified tolerances. Use Contractor's offset lines and bench marks as basis of measurements.

3.3 INSTALLATION

A. General: Refer to Section 08 44 13 "Glazed Aluminum Curtain Walls."

B. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Install in accordance with the applicable provisions of acceptance indicated under the manufacturers NOA. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight. Clean excess joint sealants from finished surfaces.

1. Cut and trim component parts of the entrance and storefront work during erection only with the approval of the manufacturer or fabricator, and in accordance with his recommendations. Restore finish completely to protect material and remove all evidence of cutting and trimming. Remove and replace members where cutting and trimming has impaired strength or appearance, as directed by Architect.
2. Set components within the erection tolerances with uniform joints. Place components on shims and fasten to supporting substrates using bolts and similar fasteners. Use stainless steel shims at structural connections only. U shaped shims at structural connections are not permitted. Use aluminum, stainless steel, or high impact polystyrene shims at other connections.
3. Do not erect components that are warped, deformed, bowed, dented, defaced or otherwise damaged as to impair its strength or appearance. Remove and replace members damaged in the process of erection.
4. Coat concealed surfaces of dissimilar materials, and any ferrous metal components, with a heavy coating of bituminous paint, zinc rich primer or other separation in accordance with manufacturer's recommendations. Where aluminum components will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
5. No holes or slots shall be burned, cut into, or field drilled in any building framing member without the written acceptance of the structural engineer.
6. Install subsills in single piece lengths. Joints, where required, shall be placed at the maximum spacing allowed by the system manufacturer and sealed to result in a splice joint that is compliant with the manufacturers subsill splicing details. Fill anchor leg receptors at the splice joints as required by the system manufacturer. Spot heads of all fasteners with sealant.
7. Attach and seal end dams at the ends of all subsills.

C. Entrance and Storefront Framing: Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

1. Install aluminum-framed entrance and storefront framing assemblies located in the exterior wall, including hardware attached thereto, in accordance with the applicable provisions of acceptance indicated under the aluminum-framed entrances and storefront manufacturers Notice of Approval (NOA) as published by Miami-Dade County, Florida.

D. Entrance Doors: Doors shall be securely anchored in place to a straight, plumb and level condition, without distortion. Adjust doors to provide a tight fit at contact points for weathertight closure and to operate smoothly, without binding, with hardware functioning properly. Weatherstripping contact, and hardware movement, shall be field tested and final adjustment, and lubrication, made for proper operation and performance of doors.

1. Install aluminum-framed entrance door assemblies located in the exterior wall, including hardware attached thereto, in accordance with the applicable provisions of acceptance indicated under the entrance door and frame manufacturers Notice of Approval (NOA) as published by Miami-Dade County, Florida.
2. Door Hardware: Refer to Section 08 71 00 "Door Hardware."
3. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.
4. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.
5. Set sill members in a bed of polyurethane sealant to provide weathertight construction. Comply with requirements of Section 07 92 00 "Joint Sealants."

E. Install glazing to comply with requirements of Section 08 80 00 "Glazing," unless otherwise indicated.

F. Install perimeter sealant to comply with requirements of Section 07 92 00 "Joint Sealants," unless otherwise indicated.

G. Concealed Sealing Components: Apply sealant and gasket components that are integral to the entrance and storefront systems in strict accordance with the each component manufacturer's printed instructions. Before applying components remove all mortar, dust, dirt, moisture, and other foreign matter that will be deleterious to the intended performance of the component. Mask adjoining exposed surfaces to avoid spilling, dripping, dropping or other unintended contact of the sealing components onto adjacent exposed surfaces.

3.4 ERECTION TOLERANCES

A. The entrance and storefront systems shall be fabricated and erected to accommodate the dimensional tolerances of the structural frame and surrounding cladding while providing the following as installed tolerances.

1. Variation from theoretical calculated position as located in plan or elevation in relation to established floors lines, column lines and other fixed elements of the structure, including variations from plumb, level, straight and member size: +/- 1/4 inch max in any 20'-0" run, column-to-column bay, or floor-to-floor height.
2. Alignment: Where surfaces abut in line, and where they meet at corners, limit offset from true alignment to 1/32 inch.
3. Variation from angle, or plumb, shown: +/- 1/8 inch max in any 10'-0" run or story height, non-cumulative.
4. Variation from slope, or level, shown: +/- 1/8 inch max in any 20'-0" run or column-to-column bay, non-cumulative.

3.5 ANCHORAGE

A. Anchorage of the entrance and storefront work to the structure and surrounding cladding shall be in accordance with the accepted shop drawings.

3.6 WELDING

A. Weld with electrodes and by methods recommended by manufacturer of material being welded, and in accordance with AWS D1.1 for concealed steel members.

B. Welds and adjacent metal areas shall be thoroughly cleaned and coated with a single coat of bituminous paint.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing agency to perform field quality-control testing indicated. Conduct tests of each specified sample installation under the direction of the testing agency in the presence of the Owner, Architect, the Contractor, various component manufacturers and fabricators and the Installer for each system incorporated in the sample installation.

B. Water Spray Without Air Pressure Difference Test: After completing the installation of test areas indicated, but before the installation of interior finishes has begun, test fixed portions of the storefront system for water penetration according to AAMA 501.2 requirements.

C. Repair or remove and replace Work that does not meet requirements or that is damaged by testing; replace to conform to specified requirements.

3.8 REMOVAL OF DEBRIS

A. All debris caused by, or incidental to, the erection of the entrance and storefront work shall be removed from the site and disposed of legally.

3.9 CLEANING

A. Clean metal surfaces promptly after installation, exercising care to avoid damage to factory finished exposed surfaces.

B. Wash glass on both faces not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer. Remove excess glazing and sealant compounds, dirt, and other substances.

C. Immediately remove any deleterious material from surfaces of aluminum.

3.10 PROTECTION

A. Institute protective measures required throughout the remainder of the construction period to ensure that entrance and storefront work will be without damage or deterioration, other than normal weathering, at time of acceptance.

END OF SECTION 08 41 13

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glazed aluminum curtain wall assemblies for the entire project. The aluminum curtain wall assemblies work includes the following:

1. Aluminum window wall, curtain wall and storefront framing.
2. Swingingentrance doors and framing, including hardware, stripping and thresholds.
3. Aluminum metal panels, canopy metal panel cladding, canopy signage, shadow box metal back panels, condensate gutter, blind pockets, sill extensions, heating element enclosures, handrails attached to framing, access windows, exterior sun control devices and louvers.
4. Aluminum trim, snap in sealant stops, flashings, parapet copings, and similar items in conjunction with aluminum curtain wall assemblies.
5. Painting and coating in conjunction with the above aluminum items.
6. Internal steel and aluminum reinforcements.
7. Internal and perimeter sealing, joint fillers, weeps, vents and gasketing systems.
8. Anchors, embedments, shims, fasteners, inserts, expansion devices, accessories, support brackets, attachments, and grout.
9. Exterior wall insulation, firesafing, and firestopping.
10. Glass and glazing for the curtain walls, entrances and storefronts.
11. Curtain wall, entrance and storefront sample installations.
12. Curtain wall laboratory mockup and testing, and field testing.
13. Security system components may be incorporated into the door and frame openings of all entrance work at the Owner's option. Cooperate with the Owner's security system contractors if the Owner chooses to incorporate security system components during the course of the Work.

B. The Owner will engage an independent testing and inspection agency to verify the adequacy of the Contractor's quality control; refer to Section 01 40 00 "Quality Requirements." Before concealing the window, window wall and curtain wall work obtain the required inspections of same from a representative of the Owner's independent testing and inspection agency.

1.2 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for each glazed aluminum curtain wall component specified.

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. Shop Drawings: Submit shop drawings showing scaled elevations, plans, and sections of the glazed aluminum curtain wall work. Full scale sections shall be prepared and submitted for details of the assemblies that cannot be shown in the elevations or sections. Include with shop drawings metal thickness of all metal components, glass thicknesses, metal finishes, location and installation requirements of door hardware and reinforcements, and all other pertinent information as necessary or requested by the Architect to indicate compliance with the Contract Documents. Details of field connections, anchorage, and their relationship to the work of others shall be clearly indicated for the coordination of the work by other building trades. Details of fastening and sealing methods and product joinery shall be shown to ensure proper performance of the field installation. No work shall be fabricated until shop drawings for that work have been approved by Architect for fabrication.

1. Show direction of coil coating applied to metal panel faces.
2. Submit with the shop drawings edge of slab firestopping test reports and project specific engineering judgments demonstrating compliance with the requirements.

D. Samples: Submit samples of the following before any work is fabricated:

1. Three paired sets of samples for each exposed metal finish required. Sample finishes shall be on the specified alloy, temper, and thickness of metal required for the work. Where finishes involve color and texture variations, include sample sets showing the full range of variations expected. Furnish samples in either 12 inch lengths of rails, or 12 inch squares of sheet.
2. Submit 18 by 24 inch cut away samples of metal panels. The metal panel samples shall demonstrate welded corner joints, reinforcements, and stiffeners
3. Submit full size samples of window washing tiebacks in exposed metal finish required. Sample finishes shall be on the specified alloy, temper, and thickness of metal required for the work.
4. Signage (Dimensional Characters): Full-size Samples of each type of dimensional character (number and letter) for the pin mounted building signage.

1.3 INFORMATIONAL SUBMITTALS

A. Structural Calculations: Submit, for information only, copies of structural calculations indicating complete compliance with the specified performance requirements. Calculations shall be prepared, signed and sealed by a Professional Engineer registered in the state wherein the work is to be erected. The Engineer shall be experienced in providing engineering services on a minimum of 3 projects for the type of curtain wall work indicated. The engineer shall provide evidence of their design methodology, analysis, including all assumptions.

B. Field Test Reports: Submit field testing reports.

C. Product Test Reports: Submit RECENT certified product test reports based on tests performed by an AAMA Accredited Laboratory clearly describing in written form, and in shop drawing form, compliance of each glazed aluminum curtain wall assembly (each window, window wall, curtain wall, entrance and storefront) with requirements indicated based on comprehensive testing.

D. Preconstruction Sealant Compatibility and Adhesion Testing: Submit test results.

E. Thermal Break Testing: Test results of structural and heat transmission values of the proposed thermal break construction are mandatory for thermally broken extrusion designs.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Instructions: Submit copies of an assembled and bound maintenance manual, describing the devices and procedures to be followed in cleaning, adjusting, and maintaining the curtain wall work. Include information for maintaining operable doors, operating hardware, and replacing weather stripping. Include structural silicone quality control plan for on-site reglazing of structural silicone glass units.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: The drawings and specifications are based on [YKK YCW 750] systems. Award the fabrication of glazed aluminum curtain wall components to a single firm specializing in the fabrication of glazed aluminum curtain wall components who has successfully produced work similar in design and extent to that required for the project, in not less than three projects of similar scope to the satisfaction of the Architect, and whose work has resulted in construction with a record of successful in-service performance for a period of 5 years. The fabricator shall have sufficient production capacity, have organized quality control and testing procedures, and published written and illustrated installation manuals, to produce and properly install the glazed aluminum curtain wall assemblies required without causing delay in progress of the Work.

1. The manufacturer and installer may be one and the same entity.
2. Implement a clear, project specific, system to track information flow and to check that the work is being engineered, and fabricated, to the most up to date revisions of the Contract Documents.
3. Quality Control Plan: Submit a project specific quality control plan demonstrating how quality management will be implemented from award to final completion.

B. Installer Qualifications: Subcontract the glazed aluminum curtain wall work to a firm which is specialized in the erection of curtain walls and who has successfully installed work similar in design and extent to that required for the Project, in not less than three projects of similar scope to the satisfaction of the Architect, and whose work has resulted in construction with a record of successful in-service performance for a period of 10 years.

1. Implement a clear, project specific, system to track information flow and to check that the work is being engineered, fabricated, and installed to the most up to date revisions of the Contract Documents.
2. Quality Control Plan: Implement a project specific quality control plan demonstrating how quality management will be implemented from award to final completion.

C. Pre-Construction Sealant Compatibility and Adhesion Testing: Test results confirming compatibility and adhesion are mandatory for all concealed and exposed sealant materials in contact with exterior glazing, stone, precast, other sealants, flashings, metal framing, and shims prior to full size sample installation construction. Refer to Section 07 92 00 "Joint Sealants" for specific testing requirements, and anticipated lead-time necessary to perform testing.

D. Standards: Comply with the applicable provisions and recommendations of the following standards below, where standards conflict the more stringent shall apply:

1. Aluminum Association (AA):

    a. "Aluminum Standards and Data", Latest Edition.
    b. "The Aluminum Design Manual", Latest Edition.

2. American Architectural Manufacturers Association (AAMA):

    a. AAMA "Metal Curtain Wall Manual."
    b. AAMA "Aluminum Curtain Wall Design Guide Manual," Volumes 1-9.
    c. AAMA "Curtain Wall Manual #10."
    d. AAMA "Aluminum Store Front and Entrance Design Guide Manual."
    e. AAMA 501.1, "Specification for Method of Test for Metal Curtain Walls for Water Penetration Using Dynamic Pressure."
    f. AAMA 501.2, "Specification for Field Check of Metal Curtain Walls for Water Leakage."
    g. AAMA 501.4, "Recommended Static Testing Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Inter-story Drift.
    h. AAMA 501.5, "Test Method for Thermal Cycling of Exterior Walls."
    i. AAMA 501.7, "Recommended Static Testing Method for Evaluating Windows, Window Wall, Curtain Wall and Storefront Systems Subjected to Vertical Inter-story Movements."
    j. AAMA 503, "Field Testing of Metal Store Fronts, Curtain Walls and Sloped Glazing Systems."
    k. AAMA 611, "Anodized Architectural Aluminum."
    l. AAMA 612, "Voluntary Specifications, Performance Requirements, and Test Procedures for Combined Coatings of Anodic oxide and Transparent Organic Coatings on Architectural Aluminum."
    m. AAMA 1801, "Acoustical Rating of Windows, Doors, and Glazed Wall Sections."
    n. AAMA 2603, "Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum."
    o. AAMA 2604, "Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix)."
    p. AAMA 2605, "Specification for Superior Performing Organic Coatings on Architectural Extrusions and Panels."
    q. AAMA TIR-A8, "Structural Performance Poured and Debridged Framing Systems."

r. AAMA TIR-A9-2014 "Design Guide for Metal Cladding Fasteners."
s. AAMA QAG-1, Quality Assurance Processing & Monitoring Guide for Poured and Debridged Polyurethane Thermal Barriers."
t. AAMA QAG-2, Quality Assurance Processing & Monitoring Guide for Polyamide Thermal Barriers."

3. American Institute of Steel Construction (AISC), "Steel Construction Manual," Current Edition.
4. American Society for Testing and Materials (ASTM):

a. ASTM C 1401, "Standard Guide for Structural Sealant Glazing."
b. ASTM E 283, "Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen."
c. ASTM E 330, "Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference."
d. ASTM E 331, "Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference."
e. ASTM E 488, Standard Test Methods for Strength of Anchors in Concrete Elements.
f. ASTM E 783, "Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors."
g. ASTM E 1105, "Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference."
h. ASTM E 1300, "Standard Practice for Determining Load Resistance of Glass in Buildings."
i. ASTM E 1886, "Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials."
j. ASTM E 1996, "Standard for Performance of Exterior Windows, Glazed Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes."

5. American Society of Civil Engineers (ASCE), ASCE 7 Minimum Design Loads for Buildings and Other Structures.
6. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), ASHRAE Fundamentals Handbook.
7. National Association of Architectural Metal Manufacturers (NAAMM), "Metal Finishes Manual."
8. Steel Structures Painting Council (SSPC): "Steel Structures Painting Manual, Vol. 2, Systems and Specifications."

9. ANSI Z97.1 and Federal Standard 16 CFR 1201, Consumer Product Safety Commission (CPSC): "Safety Standard for Architectural Glazing Materials," as published in the Code of Federal Regulations (CFR). Comply with the applicable requirements of the laws, codes, ordinances and regulations of Federal and Municipal authorities having jurisdiction, wherever requirements conflict the more stringent shall be required. Obtain approvals from all such authorities. As a minimum provide safety glazing complying with ANSI Z97.1 for Category A performance and 16 CFR Part 1201 for Category II performance.
10. Welding Standards: Welding shall be performed by skilled and qualified mechanics. Welding shall be performed in accordance with the applicable provisions of AWS D1.1 "Structural Welding Code - Steel" and AWS D1.2, "Structural Welding Code--Aluminum."
11. Builders Hardware Manufacturers Association (BHMA):

    a. ANSI/BHMA A156.10, "Power Operated Pedestrian Doors."
    b. ANSI/BHMA A156.19, "Power Assist and Low Energy Power Operated Doors."
    c. ANSI/BHMA A156.27, "Power and Manual Operated Revolving Pedestrian Doors."

12. Underwriters Laboratories (UL): Provide power door operators that comply with UL 325.
13. National Fenestration Rating Council (NFRC):

    a. NFRC 100, "Procedure for Determining Fenestration Product U-Factors."
    b. NFRC 200, "Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence."
    c. NFRC 300, "Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems."

E. Field Test for Anchor Pull Out Strength: Prior to curtain wall fabrication, perform anchor pull out tests at the existing structural framing elements identified to receive curtain wall anchorages. The data obtained from the pull out testing shall be correlated with the structural load calculations with the actual existing substrate's capability to resist wind and gravity load distributions from the anchorages.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Prior to the start of the curtain wall work, and at the Contractor's direction, meet at the site and review the construction schedule, availability of materials, installers personnel qualifications, equipment and facilities needed to make progress and avoid delays, installation procedures, testing, inspecting, and certification procedures, and coordination with other work. Meeting shall include Contractor, Owner, curtain wall installer, sealant installer, as well as any other subcontractors or material technical service representatives whose work, or products, must be coordinated with the curtain wall work.

1.6 IDENTIFICATION, DELIVERY, STORAGE, AND HANDLING

A. General: Comply with the applicable provisions of AAMA "Curtain Wall Manual #10" for the care and handling of curtain wall work from shop to site.

B. All components of the curtain wall work shall be identified after fabrication by marks clearly indicating their location in the building. Packaging of components shall be so selected to protect the components from damage during shipping and handling.

C. Storage on Site:

1. Store curtain wall components in a location and in a manner to avoid damage to the components. Stacking shall be done in a way that will prevent bending, excessive pressure, abrasion or other permanent damage of the component and its finished surfaces.
2. Store curtain wall components and materials in a clean, dry location, away from uncured concrete, masonry work, sprayed on fireproofing work, and other construction activities. Cover with non-staining waterproof paper, tarpaulin, or polyethylene sheeting in a manner that will permit circulation of air inside the covering.

D. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of metals.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of supporting structure by field measurements before fabrication so that the curtain wall work will be accurately designed, fabricated and fitted to the structure. Indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work. Use Contractor's lines and benchmarks as a basis for measurements.

B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to, power supplies, fire alarm system and detection devices, access control system, security system, building control system.

1.8 WARRANTY

A. Special Warranty: Submit a 2-year written warranty, beginning from date of substantial completion, and executed by the Contractor, manufacturer and the curtain wall installer agreeing to repair or replace components of curtain wall systems that develop defects in materials or workmanship, design and engineering, within the specified warranty period. Defects include, structural failures, sealant failures, deterioration of metals, metal finishes, and other materials beyond normal weathering, failure of operating components to function properly, uncontrolled water leakage, uncontrolled air leakage, and any other evidence of failure or deterioration of the curtain wall work to meet performance requirements.

B. Warranty; Anodized Coatings: Submit a warranty for a period of 3 years, warranting that the anodized aluminum will not develop excessive fading or excessive non-uniformity of color or shade, and will not crack, peel, pit, or corrode; all within the limits defined as follows:

1. "Excessive Fading" means a change in appearance which is perceptible and objectionable as determined by the Architect when viewed visually in comparison with the original color range samples.
2. "Excessive Non-Uniformity" means non-uniform fading during the period of the warranty to the extent that adjacent panels have a color difference greater than the original acceptable range of color.
3. "Will Not Pit or Otherwise Corrode" means there shall be no pitting or other type of corrosion discernible from a distance of 10 feet, resulting from the natural elements in the atmosphere at the project site.

C. Warranty, High Performance Organic Coatings: Submit a warranty for a period of 5 years, warranting the integrity of film and permanence of color of the high performance organic coatings for the following:

1. Color fade not to exceed 5 delta E units (Hunter) as calculated in accordance with ASTM D 2244 on exposed surfaces cleaned with clean water and a soft cloth.
2. Degree of chalking not to exceed rating No. 8 when measured in accordance with ASTM D 4214 on exposed unwashed surfaces.
3. Will not crack, check or peel.

D. Warranty, Thermosetting Acrylic Enamel Coatings: Submit a warranty for a period of 5 years, warranting the integrity of film against cracking, chipping, flaking, peeling and blistering of the thermosetting acrylic enamel coatings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Provide glazed aluminum curtain wall systems meeting or exceeding the following performance requirements:

1. Structural Properties:

a. Wind Loads: The glazed aluminum curtain wall work, including glass, shall be designed, fabricated and installed to withstand the maximum inward and outward wind pressures as required by [IBC] [ASCE 7].

1) Exposure Category: B.
2) Risk Category: III.

b. Seismic Loads: As required by [IBC] [ASCE 7].

1) Provide miscellaneous steel framing not shown on drawings which is required to satisfy seismic criteria.

c. Ice and Wind on Ice Loads: Calculated per ASCE 7 for ice sensitive elements as defined by ASCE 7. Calculations for ice and wind on ice loaded elements shall be made for strength only. Members supporting ice will not be required to be held to a specified deflection limit during ice related load events.

d. Deflection Limitations:

1) Deflections: Base calculations for the following deflections upon the combination of maximum design wind loads, building deflections, thermal stresses, and erection tolerances.

a) The deflection of the framing members for each unit of glass in a direction normal to the plane of the wall when subjected to the full code required wind loads indicated above shall not exceed 1/175 of the glass edge length or 3/4 inch whichever is less, except limit deflection of glass to 1 inch for exterior walls 1/2 inch for interior walls.
b) Deflection of Exterior Wall Louvers: L/180 of its clear span.
c) Glass, sealants and interior finishes shall not be included to contribute to framing member strength, stiffness or lateral stability.
d) Cantilever Deflection: The deflection of a framing member overhanging an anchor point shall be limited to 2L/175 where L is the length of the cantilevered member.
e) Soffit framing shall be fabricated and installed to resist its own deadloads and upward and downward windloading with a deflection not to exceed 1/360 of the distance between supports.
f) The net deflection of metal wall panels in a direction normal to the plane of the wall when subjected to the maximum inward and outward wind pressures shall not exceed 1/60 of the panel's short length span. Deflection shall be measured relative to horizontal and vertical support members with allowable deflection determined by the lesser dimension.
g) In addition to the above deflections, stone supporting aluminum framing members shall be limited to 1/600 parallel and perpendicular to the wall plane, with rotation of continuous member on kerfed stone limited to a maximum of 1/16 inch.

2) Do not permit any permanent deformation (set) in the metal framing work. Permanent deformation, fastener, weld, or gasket failure, component breakage or disengagement shall not occur under wind loading equal to 1.5 times the wind loads (positive or negative). Permanent deformation shall be taken as deflection without recovery exceeding 1/1000 times span.

e. Dead Loads:

1) Maximum full deadload deflections, parallel (in-plane) to wall plane, of framing members shall not reduce glass bite or glass coverage, to less than 75 percent of the design dimension, and shall not reduce edge clearance to less than 25 percent of design dimension or 1/8 inchwhichever is greater.
2) Limit deflections of metal members spanning door openings to 1/300. The clearance between the member and an operable door shall be no less than 1/16 inch.
3) Twisting (rotation) of the horizontals due to the weight of the glass shall not exceed 1 degree, measured between ends and center of each span.
4) Sills, Copings and Floor Closures: Capable of returning to original profile and position without permanent set after application of a 250 lb (113.4 kg) concentrated live load. Deflection under load shall be not more than 1/16 inch (1.6 mm).

f. Uniform Structural Loads: Recent satisfactory uniform wind loading tests, acceptable to the Architect, of each glazed curtain wall assembly (each window, window wall, curtain wall, entrance and storefront) shall have been conducted in accordance with the requirements of ASTM E 330 . Each assembly shall have been subjected to inward and outward acting uniform loads equal to 1.5 times the inward and outward acting design wind loads specified above under paragraph 'wind loads.' Satisfactory performance at these loads shall mean no glass or other component breakage, component disengagement, and no permanent deformation of main framing members in excess of the permanent deformation criteria specified above. The qualification of 'recent' test results is to limit the glazed curtain wall assemblies being provided for the project to only those which have been tested within the last seven years and under conditions similar to the project requirements.

1) In the absence of satisfactory test results a full scale laboratory mock up and testing program shall be required and conducted to the extent specified herein.

g. Operational (Traffic) Loads: Design and fabricate entrances to withstand the operating loads which result from heavy traffic conditions using the specified hardware, without measurable permanent deflection. Limit elastic deflections so as to provide the normal degree of rigidity required to avoid glass breakage, air leaks and other objectionable results of excessive flexibility. Provide weatherstripping at stiles, sill and head rails of door leaves, to minimize air, water and sound leaks.

1) Accommodate seismic movement as required by local code authorities to maintain exit doors in operable condition in case of seismic event.

h. Exterior Snap Covers: Exterior snap covers having a 1" or more projection shall be mechanically fastened to resist loads from snow, ice, and window washing personnel and to avoid walking from thermal movement.

B. Air Leakage:

1. Typical Conditions: Air leakage through each glazed aluminum curtain wall assembly shall not have exceeded 0.06 cfm/sq. ft. of fixed wall area when tested in accordance with ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sq. ft.
2. Swinging Doors: Air leakage through each swinging and revolving entrance door shall not have exceeded 1.0 cfm/sq. ft. of surface area when tested in accordance with ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft. with the door leaves in the closed position and the revolving door wings in the closed cross position.

C. Water Penetration:

1. Water penetration in this specification is defined as the appearance of uncontrolled water, other than condensation, on any indoor face of any part of the wall.
2. Provision shall be made to drain to the exterior face of the wall any water entering the system.
3. No uncontrolled water penetration shall have occurred when each glazed aluminum curtain wall assembly (each fixed window, window wall, curtain wall, and storefront wall) was tested in accordance with the ASTM E 331 for one 15 minute cycle at a static pressure difference of 12 lbf/sq. ft.minimum.

D. Thermal Movements: Fabricate the glazed aluminum curtain wall work to accommodate for such expansion and contraction of component materials, and supporting elements, as will be caused by surface temperatures ranging from -5 to +180 deg F, without causing noise, buckling, glass breakage, failure of joint sealants, undue stress on metal members and fasteners, failure of doors or other operating units to function properly, reduction of performance, and other detrimental effects.

1. Dimensions shown on Drawings are based on an assumed design temperature of +70 deg F. Fabrication and erection procedures shall take into account the ambient temperature range at the time of the respective operations.
2. Shadow Boxes: Shadow boxes shall be designed for an exposed surface metal temperature range of -5 to +235 deg F.

E. Building Frame Movement: Design, fabricate and install glazed aluminum curtain walls to withstand building movements including thermal movements, loading deflections, shrinkage, creep and similar movements without glass breakage, anchor failures, or structural damage. Thermal movements shall be as specified above. Building frame deflections, shrinkage, creep and other movements are available from the structural engineer.

1. Comply with the pass/fail performance criteria of AAMA 501.4 for the project specific building occupancy type for building frame movements caused by seismic and wind induced inter-story drifting.

F. Condensation Resistance: Design, fabricate and install the curtain wall systems to prevent excessive condensation on the indoor exposure of the wall with the mechanical system functioning under normal operating conditions. A computer generated thermal analysis for each primary curtain wall system showing temperature gradients through each component of the glazed aluminum curtain wall and the location of the dewpoint shall be submitted with the shop drawing package. Excessive condensation is defined as water, ice, or frost on more than 5% of the interior or internal surface of any module or component of the wall or the accumulation of uncontrolled flow of water from condensation or melted frost on the wall at any location. An interior or internal surface of any module is any surface other than an exterior surface.

G. Thermal Transmittance: Design, fabricate and install the aluminum framed curtain wall assemblies with the assembly U-factor maximum to comply with ASHRAE 90.1 and the IECC for the project specific geographic location of the building project when tested according to NFRC 100. A computer generated thermal analysis (for each primary curtain wall system; showing temperature gradients through each component of the glazed aluminum curtain wall and the location of the dewpoint shall be submitted with the shop drawing package. Indoor humidity, and indoor and outdoor temperature parameters for the project are available from the mechanical engineer.

H. Solar Heat-Gain Coefficient: Unless otherwise indicated in the glass schedules, provide glass for aluminum framed curtain wall assemblies with a assembly SHGC maximum to comply with ASHRAE 90.1 and the IECC for the project specific geographic location of the building project as determined according to NFRC 200 procedures.

I. Glass Statistical Factor: Glass thicknesses when shown on the drawings, or specified, are for convenience of detailing only and are to be confirmed by the Contractor and/or glass manufacturer. All glass for the size openings shown will be provided in thicknesses such that the probability of breakage at the design "Wind Load" will not exceed 8 lights per 1000 lights (S.F. 2.5) based on a 3 second gust wind load duration, and reflectance and shading indicated. The glass manufacturer shall provide, on request, substantiating glass breakage data if such data is not otherwise available as manufacturer's published data.

1. The nominal glass thickness permitted shall be 6.0 mm.
2. All exterior glass shall be assumed to be non-vented due to the use of interior sun screening devices such as shades and horizontal venetian blinds.

J. Sound Transmission: Design, fabricate and install exterior windows, doors, and glazed wall sections with a minimum outdoor-indoor transmission class (OITC) of 26 according to ASTM E 1332, as determined by testing according to AAMA 1801.

K. Glazing System Design: Exterior wall interior glazing channel dimensions, shall be sized to provide bite on glass, minimum edge and face clearances, with reasonable tolerances, and to receive both dry gaskets, and recessed 2 and 4-side structural silicone beads that are below the sill, head, and jamb framing sight lines.

L. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of 2 and 4 side structurally glazed curtain wall assemblies.

M. Design Modifications:

1. Submit design modifications necessary to meet the performance requirements and field coordination.
2. Variations in details or materials shall not adversely affect the appearance, durability or strength of components, nor shall such variations cause excessive stress, or deflections, to the building structural frame.
3. Maintain the general design concept without altering size of members, profiles and alignment.

2.2 MATERIALS

A. Aluminum: Conform to the requirements published in AA "Aluminum Standards and Data", referenced ASTM standards and the following. All aluminum extrusions shall be manufactured to dimensional tolerances so as to eliminate edge projection or misalignment at joints. Unless otherwise specified, provide alloy and temper as required to suit performance requirements and finish(es) indicated. Provide concealed extruded bars, rods, shapes and tubes in alloys as recommended by the fabricator to join or reinforce assembly of exposed aluminum components.

1. Alloys:

   a. Sheet and Plate: Alloy 5005 and ASTM B 209, 'Anodizing Quality.'
   b. Extruded Bars, Rods, Shapes, and Tubes: Alloy 6063 and ASTM B 221
   c. Bars, Rods, and Wire: ASTM B 211.
   d. Sand Castings: ASTM B 26
   e. Permanent Mold Castings: ASTM B 108.

2. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
3. Shapes and Thickness: Provide shapes as shown and as required to suit the performance requirements but with wall thickness of not less than the following:

   a. Minimum Wall Thickness for Structural Extrusions: 1/8 inch.
   b. Minimum Wall Thickness for Non-Structural Extrusions: 1/16 inch.

B. Carbon Steel: For carbon steel components required to join, reinforce or support the assembly of aluminum components provide carbon steel conforming to ASTM A 36/A 36M for structural shapes, plates, and bars; ASTM A 1008/A 1008M for cold-rolled sheet and strip; or ASTM A 1011/A 1011M for hot-rolled sheet and strip; ASTM A 500 or ASTM A 501 for steel tubing.

1. Refer to Section 05 50 00, Metal Fabrications, for carbon steel framing, embedments, anchors, and welding that is not primary building structure nor furnished by the curtain wall fabricator but is required to transmit live and deadloads from the curtain wall to the primary building structure.

C. Anchors and Fasteners: Fastener design for aluminum components shall be in accordance with the applicable provisions of the Aluminum Association Aluminum Design Manual AA-ADM1.

1. Material:

    a. Wet Zones: Series 300 stainless steel.
    b. Dry Zones: Carbon steel complying with either ASTM F 3125 or SAE Grade 5.

2. Anchor and Fastener Metal Alloy Types, Designations and Standards: Alloys as selected by fabricator to prevent corrosion resistance with the components fastened. Do not use self-drilling, self-tapping type fasteners.
3. Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.

D. Cast-In-Place Concrete Inserts: Anchor channel type, with filler strips, manufactured from formed hot or cold rolled carbon steel channels with flange edges returned toward web, having a minimum of two (2) stud, or I, anchors shop welded to the back of each channel, complying with ASTM A 570. Provide channels, bolts, washers, and shims hot-dip galvanized per ASTM A 153/A 153M. Width, depth, and metal thickness as required to suit performance requirements. Manufacturers of specialty inserts include the following:

1. Hilti.
2. Jordahl.
3. Halfen.

E. Concealed Flashing: Dead-soft, 0.018 inch thick stainless steel, complying with ASTM A 666, Type 304.

F. Door Hardware: Refer to Section 08 71 00 "Door Hardware."

G. Sound Deadening for Metal Panels: Type as recommended by panel manufacturer for application shown.

2.3 SEALING, GLASS AND GLAZING MATERIALS

A. Concealed Sealing Materials: All sealing materials concealed within the glazed aluminum curtain walls (i.e. glass pockets, end dams, fastener heads, and internal gutters) shall be silicone, compatible with and adherent to each material it will be in contact with, as recommended by the manufacturer to fulfill performance requirements.

1. Each concealed sealant shall be identified on the shop drawings.
2. Splice details shall be designed using silicone. Splice details shall be designed to accommodate the anticipated movement of the joint.
3. All internal sealants which come in contact with the exposed sealants shall be compatible with and adherent to the exposed sealant.

B. Exposed Sealing Materials: All sealing materials exposed at glazed aluminum curtain wall perimeter joints in contact with adjacent cladding materials: Silicone, refer to Section 07 92 00 "Joint Sealants."

C. Glass and Glazing Materials: Refer to Section 08 80 00 "Glazing."

2.4 OTHER GLAZED ALUMINUM CURTAIN WALL COMPONENTS

A. Metal Panels, Copings and Canopy Signage:

1. Supports: Metal panel, coping, and signage supports shall be custom fabricated so that the panels, copings, and signs are an integral part of the framing for the canopy and the glazed aluminum curtain wall system; are secure yet accommodate expansion and contraction; and that individual panels, copings and letters may be installed or removed with a minimum amount of disturbance to adjacent components.
2. Fabrication:

    a. Metal panels, copings, and signs shall be custom fabricated from minimum 1/8 inch thick, ASTM B 209, aluminum sheet. Provide concealed anchorage devices and reinforcements as required to erect metal panels, copings and signs to the exterior wall framing systems and as required to maintain the specified flatness tolerances.
    b. Edge Construction and Profiles: Edge construction shall be as required to secure metal panels, copings, and signs to the exterior wall framing systems and provide an air and water tight seal complying with the performance requirements. All metal panel, coping, and sign corners shall be welded and ground smooth prior to final finishing. Metal panel, coping and sign profiles are indicated on the drawings.
    c. Flatness Tolerances: Oil canning shall not be permitted; in addition anchorage devices, cover stiffeners (if any), and reinforcements shall not be visible in the finished (exposed) faces of metal panels, copings and signs.

3. Finishing: After forming metal panels, copings, and signs but before finishing, remove abrasions, scratches, die markings, and dents.
4. Apply sound deadening (dielectric separator) on the back side of metal panels.

B. Blind Pockets: Form blind pockets to the profiles shown fabricated from aluminum extrusions with end closures. Coordinate dimensions and attachment methods with blind equipment, window frames, ceiling suspension systems and other related construction to produce coordinated, closely fitting, assembly. Reinforce pockets for attachment of window treatment equipment and hardware or increase pocket metal thickness. Divide continuous pockets by means of built-in partitions and blankoff (sound attenuation blankets) insulation located to separate adjoining blind units, to coincide with window mullions, and to receive filler panel at ends of partitions.

1. Requirements applicable to "blind pockets" shall be read as being inclusive of any and all reinforcement within framing members as is necessary to the mounting of blind hardware. And,
2. Stainless steel mechanically screwed tie-down accessory hardware shall be provided and installed in framing sills as shown and as required to provide a tension tie connection for blind guide wires.

C. Condensate Gutters: Provide shop fabricated (preformed) extruded aluminum units of the type, size, and profiles required to form a complete and continuous waterproof and weatherproof gutter system complete with prefabricated corner units, expansion joints, and anchoring devices.

D. Shadow Box Metal Back Panels: Custom fabricate metal back panels of shadow box enclosures from minimum 0.08 inch thick, ASTM B 209, aluminum sheet metal. Assemble back panels to accommodate expansion and contraction. Oil canning shall not be permitted in metal back panels; in addition, metal back panel anchorage devices (if any), stiffeners (if any), and reinforcements shall not be visible in the finished (exposed) faces of metal back panels. After forming metal back panels, but before finishing, remove abrasions, scratches, die markings, and dents. Finish exposed surfaces of metal back panels using coating and a color to match the exterior snap caps of the curtain wall framing system. Provide metal back panels with an interior air seal that is concealed from view from building exterior. If interior air seal utilizes tapes, seals, or gaskets, use types that will not release volatiles, nor leave visible deposits or residues on inside of spandrel glass unit or metal back panel.

E. Sheet Metal Partition Filler Panels: Form sheet metal filler panels from 0.05 inch thick aluminum sheet for closing ends of gypsum wallboard partitions. Produce flat, flush surfaces without cracking and grain separation at bends. Incorporate reveals, trim, and concealed anchorages for attachment to adjacent surfaces. Adhesively attach vinyl foam sealant tape to filler panel edges which abut adjacent surfaces to form a continuous seal. Use vinyl foam sealant tape material set onto edge of filler panel. Uncompressed tape thickness shall be sized to fit 3/4 inch wide joint indicated with an additional thickness as required to provide a minimum 15 percent foam compression. Laminate layers of tape as recommended by the manufacturer to provide a single tape thickness for the joint indicated. Fill interior of panel with sound deadening mineral fiber insulation permanently attached to inside panel faces.

1. Vinyl Foam Sealant Tape: Adhesive-backed, closed-cell, compressible, non-extruding, sound transmission reducing, vinyl foam tape strips with approximately 10 Shore 00 hardness that allow fastener penetration without foam displacement, 0.90-inch- thick, in width 1/2-inch- less than window mullion width. Subject to compliance with specified requirements, furnish and install products by the following, or approved equal:

    a. Norseal V820 Series, Norseal V8229 Tape, Saint Gobain; black color.

F. Thermal Break Construction: Fabricate curtain walls with an integrally concealed, poured in place, urethane thermal break, located between extrusions exposed to the exterior or contacting exterior finish materials and window members exposed on the interior or contacting interior finish materials, in a manner which eliminates direct metal to metal contact between exterior and interior metal components of the curtain wall assemblies. Provide thermal breaks of low thermal conductive materials, which satisfy the performance requirements. Urethane material for thermal breaks shall have been designed for window, window wall, and curtain wall construction and have been tested to demonstrate resistance to thermal conductance and condensation. Urethane materials shall be selected which have been in successful use for a minimum of 5 years. All thermal breaks shall be formed under typical plant conditions in extrusions designed for the project and tested to confirm that the product will meet or exceed the performance requirements.

G. Slip and Separator Gaskets:

1. Bolted Slip Joints: Non-metallic, low friction material bearing temperature and moisture resistances and low abrasion properties as required to suit performance requirements.
2. Non-Bolted Slip Joints: Non-corrosive, non-toxic impregnated felt, or butyl tape with a pressure sensitive adhesive on one surface that is formulated for proper adhesion to metals indicated; gasket shall bear temperature and moisture resistance properties as required to suit performance criteria; thickness and width as required.

H. Wiper and Other System Gaskets: Continuous extruded rubber with cross sectional profile, physical properties, and tolerances as recommended by the curtain wall manufacturer, and as required, to comply with the performance requirements specified.

1. Wiper Gasket Color: Black.

I. Baffle Material: Reticulated foam baffle material with a pore count (ppi) as required by assembly fabricator to suit performance requirements.

J. Insulation: Foil-faced, slag-wool-/rock-wool-fiber rigid board insulation for curtain walls; refer to Section 07 21 00 "Thermal Insulation" for insulation to be used in glazed curtain wall assemblies.

K. Firesafing and Firestopping: Unfaced mineral wool safing insulation topped with smoke stopping material, refer to Section 07 84 43 "Joint Firestopping" for firesafing and firestopping to be used in conjunction with glazed curtain wall assemblies.

1. Design of the firesafing and firestopping system shall be the responsibility of the glazed aluminum curtain wall fabricator and installer.
2. The firesafing and firestopping system shall have been either tested by approved testing laboratories such as UL, or the firesafing and firestopping system shall bear an engineering judgment. In either case the firesafing and firestopping system shall be submitted by the glazed aluminum curtain wall fabricator and installer.
3. Glass and glazing connections to the underside of slab shall be protected with safing mechanically fastened in place.

L. Snap In Sealant Stops: Provide rigid PVC sealant stops of profile and hardness as recommended by the window fabricator, and fabricated to a cross sectional profile to interlock with aluminum extrusions at all window perimeters.

M. Floor Cover Plates: Thickness of floor cover plates to be 3/16 inch, profiles as indicated on the drawings, or if not indicated, as accepted by the Architect on the shop drawings.

N. Window Sill Extensions: Thickness to match non-structural extrusions, profiles as indicated on the Drawings.

O. Tension Wire Attachments: Provide custom adjustable tensioning wire attachments at sills to accommodate installation of horizontal venetian blinds at inclined curtain wall assemblies. Refer to Section 12 21 13 "Horizontal Louver Blinds" for additional information.

P. Heat Tracing Cables at Copings: Refer to Division 23 and 26 sections for heat tracing cables.

2.5 FABRICATION

A. General: Fabricate the glazed aluminum curtain walls to the designs, shapes, and sizes shown using the materials specified and shown to produce assemblies that meet or exceed the performance requirements. To the greatest extent possible complete fabrication, assembly, finishing, hardware applications and other work before shipment to Project site.

B. Joints in Metal Work: All exposed work shall be carefully fitted and matched to produce continuity of line and design, with all joints, being accurately fitted for hairline contact and rigidly secured. Where additional rigidity or strength is required to satisfy the performance requirements reinforce curtain wall components with aluminum or carbon steel shapes, bars, and plates.

C. Shop Assembly: As far as practicable, all fitting and assembly work shall be done in a fabrication shop.

1. Framing members attaching curtain wall components to building supports shall provide for 3-way adjustment to accommodate fabrication and construction tolerances, and allow for thermal and building movements.
2. Provide vents, weepholes and internal water passages in the glazing framing recesses as recommended by the respective glass and framing manufacturers to conduct infiltrating water to the exterior, and to avoid condensation at glass spandrel unit air spaces. Provide weep baffles secured to inside of frame behind vents and weepholes.
3. At shadow box enclosures provide vents, weepholes and internal water passages in the glazing framing recesses from the shadow box interior space to outside air to conduct infiltrating water to the exterior, and to avoid condensation within the interior air space between the glass spandrel unit and the shadowbox enclosure. Provide weep baffles secured to inside of frame behind vents and weepholes.
4. Provide flush endcaps for all mullion extension cap extrusions.
5. Provisions for reglazing from interior for vision glass and exterior for spandrel glazing or panels.

D. Exposed Fasteners: Not permitted.

E. Protection of Metals: Wherever dissimilar metals are in contact, except in the case of aluminum in contact with galvanized steel, zinc, separate such surfaces with a coating of zinc rich primer, bituminous paint, or separation gaskets as the condition requires. Wherever aluminum comes in contact with concrete surfaces separate such surfaces with a coating of zinc rich primer, bituminous paint, or separation gaskets as the condition requires.

F. Welding: Complete the welding of exposed surfaces prior to finishing.

1. All welding shall be in accordance with the recommendations of the AWS and shall be performed with electrodes and/or by methods recommended by suppliers of the metal being welded. Fabricate welded aluminum assemblies so that fraying surfaces are free rinsing and will not trap coating solutions.
2. Welds behind finished surfaces shall be so performed as to eliminate distortion, and discoloration, on the finished side. Plug, puddle, and spot welding are not permitted. Provide low heat filled welds using a chill bar on finished side to eliminate dimpling, distortion, and/or discoloration on the finished side. If weld heads appear on the finished surface, the weld head shall be ground, and polished to match and blend with the finish on adjacent parent metal. Weld spatter and welding oxides on finished surfaces shall be removed immediately.
3. At joints where welding cannot be performed use concealed stainless steel fasteners to join assembly.

G. Shop Painting of Carbon Steel: Ungalvanized steel items shall be thoroughly cleaned of all loose scale, filings, dirt, and other foreign matter, in accordance with SSPC SP3 "Power Tool Clean," and painted with coating as specified for carbon steel surfaces.

2.6 ALUMINUM FINISHES

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

B. Finish Application:

1. Apply high performance organic coatings to all exposed exterior surfaces of glazed aluminum curtain wall components. Apply thermosetting acrylic enamel coatings to all exposed interior surfaces of glazed aluminum curtain wall components.

    a. All exposed/cut ends shall be post fabricated/finished to inhibit filofilm corrosion.

2. Adhesion and Compatibility Testing: Test samples of aluminum coatings on aluminum will be required for compatibility and adhesion testing of all sealants proposed for use on framing components. Refer to Section 07 92 00 "Joint Sealants."

C. Appearance of Finished Work: During production, maintain large size color range samples for use in comparing against production material. Variations in appearance of abutting or adjacent pieces are acceptable if they are within the range of approved samples. Noticeable variations in the same piece are not acceptable.

D. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

E. High-Performance Organic Coating Finish: AA-C12C42R1x and the following:

1. Polyvinylidene fluoride finish coating containing not less than 70 percent of "Kynar 500" or "Hylar 5000" fluorocarbon resin specially formulated for spray application to extrusions and preformed aluminum metal shapes. Coating films shall be uniform and visibly free from flow lines, streaks, blisters, sags or other surface imperfections in the dry-film state on all surfaces.

    a. Metal Preparation and Pretreatment: Pretreatment of aluminum surface and application of the finish shall be performed under specifications issued by the licensed formulator to approved applicator and the following as a minimum:

        1) The products used to form the chemical conversion coating on aluminum extrusions shall conform with ASTM D 1730, Type B, Method 5 (Amorphous Chromium Phosphate Treatment), Method 7 (Amorphous Chromate Treatment), or Trivalent Chrome Treatment.

            a) All aluminum framing surfaces indicated to receive structural glazing compounds shall be amorphous chromate phosphate wash-coat pretreatment; (a.k.a. Alodine treated) as a minimum; mill finishes are prohibited.

        2) The coating weight of the chemical conversion coating shall be a minimum of 40 mg. per ft.2 on exposed surfaces as specified in ASTM B 449, Section 6, Class I. Processing shall conform with that specified in ASTM B 449, Section 5.

    b. Thickness:

        1) Fluoropolymer 2-Coat Coating System: Minimum 1.2 mil total dry film thickness (0.25 mil primer +/- 0.05 mil and 1.0 mil topcoat).

    c. Coating Performance Criteria: Meets or exceeding AAMA 2605.
    d. Color: One custom color to be determined by Architect.
    e. Manufacturer, Coating System:

        1) Two Coat, Opaque System; one of the following:

            a) PPG Paints; Duranar.
            b) Sherwin-Williams (formally Valspar, Inc.); Fluropon Standard.

2.7 COATINGS FOR CONCEALED METAL SURFACES

A. General: The following protective coatings shall be applied to surfaces of metals which are to be concealed in the construction:

1. Coating for Carbon Steel: Hot dip galvanized, complying with ASTM A 123.
2. Coating for Aluminum, and Carbon Steel: Where aluminum or carbon steel surfaces are to be in contact with each other or in contact with dissimilar materials such as masonry or concrete, and where hot dip galvanizing of carbon steel is incompatible with component parts because of galvanic action or component fabrication tolerances provide one of the following:

    a. Bituminous Paint: Cold-applied, non-sagging, bituminous paint complying with ASTM D 1187. Apply in two coats for an overall minimum dry film thickness of 25 mils.
    b. Zinc Rich Primer: Organic zinc-rich primer, complying with SSPC-Paint 20.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate glazed aluminum curtain wall work with the work of other Sections and provide items to be placed during the installation of other work at the proper time to avoid delays in the work.

B. Place such items, including concealed overhead framing, accurately in relation to the final location of glazed aluminum curtain wall components.

3.2 EXAMINATION

A. Examine the substrates, adjoining construction, and conditions under which the Work is to be installed. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Before beginning installation of the glazed aluminum curtain wall work examine all parts of the existing building structural frame and the existing building cladding indicated to support the glazed aluminum curtain wall work. Notify Contractor in writing, of any dimensions, or conditions, found which will prevent the proper execution of the glazed aluminum curtain wall work, including specified tolerances. Use Contractor's offset lines and bench marks as basis of measurements.

3.3 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing glazed aluminum curtain wall systems. [**Install in accordance with the applicable provisions of acceptance indicated under the manufacturers NOA.**] Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints. Loose particles present or resulting from fabrication or field cutting and drilling shall be removed by blowing out joints with oil free compressed air, or by vacuuming joints. Remove protective coatings, oils from cutting and drilling operations, and residue on metallic surfaces with solvents that leave no residue. Do not allow solvent to air dry without wiping. Use only lint free towels for wiping of surfaces. Wipe metal surfaces with IPA (isopropyl alcohol) or xylene unless otherwise required by compatibility and adhesion testing results. Seal joints watertight. Clean excess joint sealants from finished surfaces.

1. Cut and trim component parts of the glazed aluminum curtain wall work during erection only with the approval of the manufacturer or fabricator, and in accordance with his recommendations. Restore finish completely to protect material and remove all evidence of cutting and trimming. Remove and replace members where cutting and trimming has impaired strength or appearance, as directed by Architect.
2. Set components within the erection tolerances with uniform joints. Place components on shims and fasten to supporting substrates using bolts and similar fasteners. Use stainless steel shims at structural connections only. U-shaped shims at structural connections are not permitted. Use aluminum, stainless steel, or high impact polystyrene shims at other connections.
3. Do not erect components that are warped, deformed, bowed, dented, defaced or otherwise damaged as to impair its strength or appearance. Remove and replace members damaged in the process of erection.
4. Coat concealed surfaces of dissimilar materials, and any ferrous metal components, with a heavy coating of bituminous paint, zinc rich primer or other separation in accordance with manufacturer's recommendations. Where aluminum components will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
5. No holes or slots shall be burned, cut into, or field drilled in any building framing member without the written acceptance of the structural engineer.

B. Glazed Aluminum Curtain Wall, Entrance and Storefront Framing: Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

1. Install curtain wall, entrance and storefront framing assemblies located in the exterior wall, including hardware attached thereto, in accordance with the applicable provisions of acceptance indicated under the glazed curtain wall manufacturers Notice of Approval (NOA) as published by Miami-Dade County, Florida.

C. Entrance Doors: Doors shall be securely anchored in place to a straight, plumb and level condition, without distortion. Adjust doors to provide a tight fit at contact points for weathertight closure and to operate smoothly, without binding, with hardware functioning properly. Weatherstripping contact, and hardware movement, shall be field tested and final adjustment, and lubrication, made for proper operation and performance of doors.

1. Install entrance door assemblies located in the exterior wall, including hardware attached thereto, in accordance with the applicable provisions of acceptance indicated under the entrance door and frame manufacturers Notice of Approval (NOA) as published by Miami-Dade County, Florida.
2. Door Hardware: Refer to Section 08 71 00 "Door Hardware."
3. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.
4. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.
5. Set sill members in a bed of silicone sealant to provide weathertight construction. Comply with requirements of Section 07 92 00 "Joint Sealants."
6. Set automatic entrance door header assemblies, operating brackets, and guides level and true to location with anchorage for permanent support.
7. Install complete automatic door operator system in accordance with door manufacturer's instructions including controls, control wiring, and power units.

    a. Refer to Division 26 Sections for connection to electrical power distribution system.

D. Grilles, Louvers, Metal Panels, Copings and Signs: Install components plumb and true in alignment with established lines and grades.

E. Sheet Metal Partition Filler Panels: Locate and place partition filler panels plumb, level, and in alignment with adjacent construction, with uniform reveals as shown. Provide concealed foam tapes, and install as the installation progresses to make installations acoustically sealed and light tight. Do not penetrate window and curtain wall framing with any type of fastenings.

F. Canopy Metal Panels: Erect to levels and slopes indicated, in proper alignment and relation to established lines and grades. Do not use fastening systems which will telegraph through or deform canopy metal panels in any way.

G. Exterior Wall Maintenance Equipment: Install components plumb and true in alignment with established lines and grades and in compliance with the building maintenance system consultant's criteria.

H. Flashing: Install flashings fabricated from specified flashing material to the profiles shown. Flashings shall be furnished in single piece lengths. Laps and joints, where required, shall be lap seamed by a minimum of 4 inches with lap completely embedded in sealant. Mechanical fasteners shall be used where necessary to maintain contact of overlapping elements. Spot heads of all fasteners with sealant. Refer to Section 07 62 00 "Sheet Metal Flashing and Trim."

I. Install glazing to comply with requirements of Section 08 80 00 "Glazing," unless otherwise indicated.

J. Install perimeter sealant to comply with requirements of Section 07 92 00 "Joint Sealants," unless otherwise indicated.

K. Concealed Sealing Components: Apply sealant and gasket components which are integral to the glazed aluminum curtain wall systems in strict accordance with the each component manufacturer's printed instructions. Before applying components remove all mortar, dust, dirt, moisture, and other foreign matter that will be deleterious to the intended performance of the component. Mask adjoining exposed surfaces to avoid spilling, dripping, dropping or other unintended contact of the sealing components onto adjacent exposed surfaces.

L. Field Applied Insulation:

1. Exterior Wall Building Insulation: Install insulation materials as specified in Section 07 21 00 "Thermal Insulation."
2. Firesafing: Clean debris from behind curtain wall framing during erection and provide temporary closures to prevent further accumulation of debris. Install firesafing to comply with local authorities having jurisdiction and AAMA TIR-A3 "Fire Resistive Design Guidelines for Curtain Wall Assemblies." Install firesafing with securely anchored metal flanges or make equivalent provisions to prevent dislocation. Comply with the requirements of Section 07 84 43 "Joint Firestopping."

3.4 ERECTION TOLERANCES

A. The glazed aluminum curtain wall systems shall be fabricated and erected to accommodate the dimensional tolerances of the structural frame and surrounding cladding while providing the following as installed tolerances.

1. Variation from theoretical calculated position as located in plan or elevation in relation to established floors lines, column lines and other fixed elements of the structure, including variations from plumb, level, straight and member size: +/- 1/4 inch max in any 20'-0" run, column-to-column bay, or floor-to-floor height.
2. Alignment: Where surfaces abut in line, and meet at corners, limit offset from true alignment to 1/32 inch.
3. Variation from angle, or plumb, shown: +/- 1/8 inch max in any 10'-0"run or story height, non-cumulative.
4. Variation from slope, or level, shown: +/- 1/8 inch max in any 20'-0"run or column-to-column bay, non-cumulative.

3.5 ANCHORAGE

A. Anchorage of the glazed aluminum curtain wall work to the structure and surrounding cladding shall be in accordance with the accepted shop drawings.

3.6 WELDING

A. Weld with electrodes and by methods recommended by manufacturer of material being welded, and in accordance with AWS D1.1 for concealed steel members.

B. Welds and adjacent metal areas shall be thoroughly cleaned and coated with a single coat of bituminous paint.

3.7 REMOVAL OF DEBRIS

A. All debris caused by, or incidental to, the erection of the glazed aluminum curtain wall work shall be removed from the site and disposed of legally.

3.8 CLEANING

A. Clean metal surfaces promptly after installation, exercising care to avoid damage to factory finished exposed surfaces.

B. Wash glass on both faces not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer. Remove excess glazing and sealant compounds, dirt, and other substances.

C. Immediately remove any deleterious material from surfaces of aluminum.

3.9 PROTECTION

A. Institute protective measures required throughout the remainder of the construction period to ensure that glazed aluminum curtain wall work will be without damage or deterioration, other than normal weathering, at time of acceptance.

3.10 DEMONSTRATION

A. Engage automatic entrance door manufacturer's installer to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrance doors as specified below:

1. Train Owner's maintenance personnel on procedures and schedules for starting up and shutting down, troubleshooting, servicing, complying with safety requirements, and maintaining equipment and schedules.
2. Review data in maintenance manuals. Refer to Section 01 77 00 "Closeout Procedures."
3. Review data in maintenance manuals. Refer to Section 01 78 23 "Operation and Maintenance Data."

B. Schedule training with Owner with at least seven days' advance notice.

END OF SECTION 08 44 13

SECTION 08 71 13 - AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes power door operators for swing doors.

1. Security system components may be incorporated into the door and frame openings indicated to receive power door operators at the Owner's option. Cooperate with the Owner's security system contractors if the Owner chooses to incorporate security system components during the course of the Work.

1.2 DEFINITIONS

A. Activation Device: A device that, when actuated, sends a signal to an automatic door operator to open a door.

B. Safety Device: Device that prevents a door from opening or closing.

1.3 COORDINATION

A. Templates: Obtain and distribute templates for doors, frames, and other work specified to be factory prepared for installing power door operators. Check shop drawings of adjacent work to confirm that adequate provisions are made for locating and installing power door operators to comply with indicated requirements.

B. Electrical System Roughing In: Coordinate layout and installation of power door operators with connections to power supplies and security access control systems (if any).

1.4 ACTION SUBMITTALS

A. Product Data: Submit product data for each door operator type required. Include manufacturer's standard details, material descriptions, dimensions of individual components and profiles, certified performance reports, installation instructions, and parts lists.

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. Shop Drawings: Submit shop drawings showing fabrication and installation details for automatic door operators. Include locations and elevations of door openings indicating activation and safety devices.

1. Wiring Diagrams: Detail wiring for power operator, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

D. Samples: Submit 3 inchsquare samples for each exposed finish required.

1.5 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

B. Reports: Submit field adjustment test reports.

C. Warranties: Submit specified warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Submit maintenance, emergency, and operation data for power door operators.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Engage a factory trained installer, with a minimum of 3 years successful experience in the installation of power door operators and, who is an authorized representative of the product manufacturer for both installation and maintenance of power door operators required for this Project.

B. Source Limitations: Obtain automatic door operators through one source from a single manufacturer.

C. BHMA Standard: Provide and install power door operators that comply with applicable requirements of BHMA A156.19, "Power Assist and Low Energy Power Operated Doors."

D. UL Standard: Provide power door operators that comply with UL 325. All electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the authorities having jurisdiction, and marked for intended use.

E. Fire-Rated Doors and Emergency Exit Openings: Provide door operators that comply with NFPA 80 requirements for doors in emergency exits that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252, and UL 10C "Standard for Positive Pressure Fire Tests of Door Assemblies."

1.8 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of supporting structure by field measurements before fabrication so that the power door operator work will be accurately fabricated and fitted to the structure. Indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work. Use Contractor's lines and benchmarks as a basis for measurements.

1.9 WARRANTY

A. Special Warranty: Submit a written warranty, executed by the manufacturer, agreeing to repair or replace components of the power door operator system that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Faulty or sporadic operation of operator or activation and safety devices.
2. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.

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

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Transom Mounted Power Door Operator Products and Manufacturers: Provide electromechanical, transom mounted, power door operators complying with BHMA A156.19 and UL 325. One of the following:

1. 4100 LE Heavy Duty Low Energy Door Operator; Horton Automatics Div. of Overhead Door Company.
2.
3. 4630/4640; LCN Closers, an Allegion PLC Company.
4. ED900; Dormakaba.

2.2 GENERAL DOOR OPERATOR REQUIREMENTS

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

1. Provide door operators with features for field adjustment of opening speed, closing speed, back check, hold open time, opening force, and acceleration during opening and recycling for soft start.
2. Provide door operators with precision machined gear systems, and motors, especially engineered and fabricated by the power door operator manufacturer for the use indicated. Fabricate gear systems and motors complete with sealed bearings, all weather lubricants and fluids, and vibration and noise isolation to provide long term, quiet and smooth service.
3. Provide door operators with microprocessor controls to accommodate site specific security system interface conditions such as required for card reader access, electric strike delay timers, electric strike power functions, electromechanical locks, and electromagnetic locks.
4. Provide door arm assemblies finished to match exposed housing.

B. Exposed Housing: Extruded aluminum cover, concealing all operating parts except arms and manual control switches, with provisions for maintenance access. Provide with fasteners concealed when door is in closed position. Provide exposed housing in manufacturer's standard natural anodized finish complying with NAAMM AA-M12C22A31 (Architectural Class II Clear Anodized Coating) unless otherwise indicated.

2.3 SWINGING DOOR OPERATORS

A. Electromechanical Operators for Swinging Doors: Manufacturer's standard electromechanical unit with doors power opened and spring closed, with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, and with easy manual operation including spring closing when power is off. Provide operator action as indicated and mounting as follows:

1. Operator Mounting Type: Surface-mounted overhead operator.
2. Power-Assisted and Low-Energy Operators: Provide power-assisted and low-energy operators meeting requirements of BHMA A156.19 and ADA's "Accessibility Guidelines for Buildings and Facilities" (ADAAG) for "Automatic Doors and Power-Assisted Doors."

2.4 OPERATOR CONTROLS

A. Touchless Switches (Actuators): Manufacturer's standard semiflush, wall-mounted, door-control switch plate for operation by hand waving. Install a touchless actuator on each side of each automatic swinging entrance door.

B. Wireless or Remote Radio Control Actuators: Manufacturer's standard radio control consisting of a receiver and battery-operated, push plate activated, wall mounted, transmitter.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame supports, and other conditions affecting performance of power door operators. Examine roughing-in for electrical and security services to verify actual locations of connections, and to verify that the proper types of electrical and security services have been provided, before power door operator installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install complete power door operator system according to manufacturer's written instructions and BHMA A156.19, including activation and safety devices, control wiring, and remote power units.

3.3 ADJUSTING

A. Adjust power door operators and activation and safety devices to operate smoothly, easily, and properly, quietly, and for a safe operation and weathertight closure without binding, scraping, and excessive noise. Adjust doors with low energy door operators to function according to BHMA A156.19.

B. Lubricate operators, hardware and other moving parts.

C. Repair damaged exposed component finishes after completing power door operator installation.

END OF SECTION 08 71 13

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Glazed curtain walls.
4. Glazed entrances.
5. Interior borrowed lites.
6. Storefront framing.

B. Related Requirements:

1. Refer to Section 08 44 13 "Glazed Aluminum Curtain Walls," Section 08 41 13 "Aluminum-Framed Entrances and Storefronts," Section 08 41 26 "All-Glass Entrances and Storefronts" for requirements applicable to single subcontract responsibility for glazing.

1.2 ACTION SUBMITTALS

A. Product Data: Submit product data for each glass product and glazing material indicated.

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. Samples: Label samples to indicate product, characteristics, and locations in the Work. Furnish samples of the following:

1. Except for clear glass, submit samples of each glass type specified, in the form of 12 inch square Samples.
2. Submit samples of each glass type specified where production run variations and defects are expected.
3. Furnish 12 inch square glass samples with break-out window indicators applied thereon.

1.3 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

B. Manufacturer Certificates: Submit a letter from glass manufacturer certifying that he has reviewed the glazing details proposed for the Project, including the use of gaskets and sealants, and that each product to be furnished is recommended for the application shown.

C. Design Data: Submit the following from the glass manufacturer:

1. Thermal Stress Analysis: For each exterior glass unit type, each building elevation. The analysis shall clearly indicate all the expected service temperature ranges and the effects of partial and full shading on the glass. Append to the thermal stress analysis a statement from the glass manufacturer that based upon this analysis that the resulting thermal stresses will not reduce the specified "statistical probability of breakage."
2. Wind Load Analysis: For each glass unit type, each building elevation. The analysis shall clearly indicate that the statistical probability of breakage at the design wind pressure will not exceed the specified statistical probability of breakage.

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. Material Certificates: Submit glass treatment certificates signed by manufacturer of the heat-soaked glass products certifying that products furnished comply with requirements.

E. Product Test Reports: Submit product test reports for each type of glazing sealant and gasket indicated.

F. Warranties: Submit special warranties specified in this Section.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Deliver in manufacturer's containers suitable for storing, clearly labeled as to type, size, and thickness. Include manufacturer's instructions for care and storage of glass. Store on the premises where directed.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations for Glass and Glazing Accessories: Obtain glass and glazing accessories from one source for each product indicated below:

1. Primary glass.
2. Coated glass.
3. Heat-treated glass, including heat-strengthened, tempered, and heat-soaked glass.
4. Insulating glass.
5. Laminated glass.
6. Glazing gaskets.
7. Formed or "slumped" glass.

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

D. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

E. Safety Glass: Comply with the applicable requirements of the laws, codes, ordinances and regulations of Federal and Municipal authorities having jurisdiction. Wherever requirements conflict, the more stringent shall be required. Obtain approvals from all such authorities. As a minimum, provide Category II materials complying with testing requirements in 16 CFR 1201 (Consumer Product Safety Commission "Safety Standard for Architectural Glazing Materials," as published in the Code of Federal Regulations) and ANSI Z97.1 for Category A performance.

1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction. Locate permanent markings in one corner, and in the same location, of each glass lite in accordance with the requirements of the SGCC labeling guidelines. Markings shall have a nominal size of no greater than 1-inch in diameter, and be located with glass edge clearances, at the corner, by not more than 3/4-inch up and 3/4-inch over.

F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Glazing Manual" and "Laminated Glass Design Guide."
2. IGMA Publications: IGMA TM-3000, "Vertical Glazing Guidelines."

G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the Insulating Glass Certification Council (IGCC) or of the Associated Laboratories, Inc. (ALI).

H. Sample Installations: Refer to Section 08 44 13 "Glazed Aluminum Curtain Walls" for requirements applicable to sample installations.

1. Representatives of glass and glazing materials manufacturers, together with Contractor's field supervisor for glazing, shall be present during construction and field testing (if any) of sample installations.
2. Prepare sample installations where shown and as required to match approved shop drawings and the Contract Documents in all respects before proceeding with the Work.
3. Accepted sample installations may remain as a portion of the completed Work.

I. Pre-Construction Testing:

1. Bow and Warp Distortion (Flatness) Tolerance Testing:

   a. Prior to the visual observation by the Architect and Owner of the preconstruction glass mockups, measure each mockup lite for bow and warp in accordance with ASTM C 1048. Measure the lites on a vertical plane with an aluminum straight edge or fishing line.

      1) Measure the mockup glass lites for compliance with the bow and warp tolerances under Article "Heat-Treated Float Glass," Paragraph "Flatness Tolerances."

   b. Document and record results for each glass lite. Tag each glass lite that falls outside of the maximum bow and warp limits and certify that these non-conforming glass lites will not be incorporated into the Work.

      1) Provide written documentation of the bow and warp readings in fractions of an inch or millimeters for each mockup glass lite to the Owner and Architect at the preconstruction glass mockup meeting. Provide additional written documentation as requested by the Owner and Architect.

2. Roll Ripple Distortion (Flatness) Tolerance Testing:

   a. Prior to the visual observation by the Architect and Owner of the preconstruction glass mockups, measure each monolithic lite in the mockup containing low emissivity coated, unfritted, heat-treated glass having a 1/4-inch- thickness or greater using a LiteSentry or Osprey Series type optical scanning measurement device complying with ASTM C 1652 for digital grid scanning glass devices. Measure each monolithic mockup lite having 100 percent full screen, frit coated monolithic heat-treated glass having a 1/4-inch- thickness or greater using a trolley type scanning measurement device complying with ASTM C 1651.

      1) Measure the monolithic mockup glass lites for compliance with the flatness tolerances under Article "Heat-Treated Float Glass," Paragraph "Flatness Tolerances."

   b. Document and record results for each glass lite. Tag each glass lite that falls outside of the maximum flatness limits and certify that these non-conforming glass lites will not be incorporated into the Work.

1) Provide written documentation of the flatness readings in fractions of an inch, in millimeters, and in millidiopters, for each mockup glass lite to the Owner and Architect at the preconstruction glass mockup meeting. Provide additional written documentation as requested by the Owner and Architect.

3. Color Tolerance Testing:

a. Prior to the visual observation by the Architect and Owner of the preconstruction glass mockups, measure each monolithic mockup glass unit using either an off-line, or on-line, spectrophotometer. Color measurement shall be taken from the uncoated side.

1) Tolerance limits for the color variation shall be as accepted on the visual mockup.

b. Document and record results for each glass unit. Tag each unit of glass that falls outside of the color variation limits and certify that these non-conforming glass units will not be incorporated into the Work.

J. Quality Control (Production) Testing: As a minimum, provide the following quality control (production) testing for the exterior glass units:

1. Bow and Warp Distortion (Flatness) Tolerance Testing:

a. During the production of the heat-treated glass lites, measure for bow and warp in accordance with ASTM C 1048. Measure the lites on a vertical plane with an aluminum straight edge or fishing line.

1) Measure the monolithic glass lites for compliance with the bow and warp tolerances under Article "Heat-Treated Float Glass," Paragraph "Flatness Tolerances," unless otherwise accepted by the Owner and Architect at the preconstruction glass mockup.

b. During glass production, and once an hour, randomly select a single heat-treated glass lite and measure it. Document and record results. Tag each glass lite that falls outside of the maximum bow and warp limits and certify that these non-conforming glass lites were not incorporated into the Work.

c. Provide written documentation of the bow and warp readings in fractions of an inch or millimeters for each tested glass lite to the Owner and Architect, if requested. Provide additional written documentation as requested by the Owner and Architect.

2. Roll Ripple Distortion (Flatness) Tolerance Testing:

a. During the production of the heat-treated glass lites, measure each low emissivity coated, unfritted, monolithic glass lite having a 1/4-inch- thickness or greater using a LiteSentry or Osprey Series type optical scanning measurement device complying with ASTM C 1652 for digital grid scanning glass devices. During the production of the 100 percent full screen, frit-coated monolithic heat-treated glass lites having a 1/4-inch- thickness or greater, and at a frequency of at least once an hour, randomly select a monolithic single lite and measure it using a trolley type scanning measurement device complying with ASTM C 1651.

1) Measure the monolithic glass lites for compliance with the flatness tolerances under Article "Heat-Treated Float Glass," Paragraph "Flatness Tolerances," unless otherwise accepted by the Owner and Architect at the preconstruction glass mockup.

b. Document and record results for each glass lite. Tag each glass lite that falls outside of the maximum flatness limits and certify that these non-conforming glass lites were not incorporated into the Work.

1) Provide written documentation of the flatness readings in fractions of an inch, in millimeters, and in millidiopters, for each glass lite to the Owner and Architect, if requested. Provide additional written documentation as requested by the Owner and Architect.

3. Color Tolerance Testing: During production, test monolithic coated and coated insulating glass units for color compliance as follows:

a. Establish a color target selected from the accepted pre-construction glass mockup unit(s) and perform quality control color control checks using either an off-line, or on-line, spectrophotometer. Examples of acceptable off-line devices include Minolta 2500d/2600d; examples of acceptable on-line devices include Benchmodel Spectrophotometers. Color measurement shall be taken from the uncoated side.
b. Frequency: Test a minimum of one unit every hour.
c. Document and record results for each glass unit. Tag each unit of glass that falls outside of the color variation limits and certify that these non-conforming glass units will not be incorporated into the Work.

4. Insulating Glass Unit Testing Requirements: During production, test insulating glass units as follows:

a. Butterfly Unit Adhesion Pull Testing:

1) Adhesion Criteria: Comply with the pass/fail requirements of the sealant manufacturer's published guidelines and/or sealant manufacturer's certification audit requirements/recommendations. Minimum pull back to 30 degrees from horizontal with no adhesive failure.
2) Frequency: Test one minimum 4-by-6-inch- size unit each eight-hour shift and after each sealant drum change.

3) Test units shall be fabricated on the same production line and processing equipment and with the same spacers and sealant used in the production of the insulating glass units fabricated for the Project.

b. Desiccant Temperature Rise Testing:

1) Test Criteria: Comply with the desiccant manufacturer's written recommendations.
2) Frequency: Test a minimum of once every eight-hour shift and after each drum change.

c. Bow/Warp and Air Space Measurement Concave/Convex Testing:

1) Measure and record bow and warp once every hour on a vertical plane with an aluminum straight edge or with a laser.
2) Measure and record unit center air space a minimum of once an hour with a checking gage (FDR Designs, or equal) and visually inspect all units.

d. Skips and voids in the primary or secondary seals are prohibited and maximum gap at primary/secondary seal interface shall be 1 inch in length and 3/32 inch in width.
e. Document and record results. Provide additional documentation upon request by the Owner or Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting (using either breather or capillary tubes) and sealing.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.8 WARRANTY

A. Manufacturer's Special Warranty on Ceramic Frit-Coated-Glass Products: Written warranty, made out to Owner and signed by coated-glass manufacturer agreeing to furnish replacements for those coated-glass units whose coatings flake, peel, or crack within the specified warranty period indicated below. Upon notification of such deterioration within the warranty period, furnish replacement glass units for those glass units whose coatings have flaked, peeled or cracked at the convenience of the Owner.

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

B. Manufacturer's Special Warranty on Laminated Glass: Written warranty, made out to Owner and signed by laminated-glass manufacturer agreeing to furnish replacements for laminated-glass units that develop edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those specified within the warranty period indicated below. Upon notification of such deterioration within the warranty period, furnish replacement glass units for those glass units having edge separation, delamination, and blemishes at the convenience of the Owner.

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

C. Manufacturer's Special Warranty on Insulating Glass: Written warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to furnish replacements for insulating-glass units whose hermetic seal has failed within specified warranty period indicated below. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass. Upon notification of such deterioration within the warranty period, furnish replacement glass units for failed glass units at the convenience of the Owner.

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

D. Heat-Soaked Tempered Glass Special Warranty: Executed by the Contractor, manufacturer and the glass installer agreeing to replace glass units that spontaneously break as a result of Nickel Sulfide (NiS) inclusions within the specified warranty period without material or labor charges to the Owner.

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

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Refer to Finish Schedule on the Drawings for the extent of glass types and locations. Glass types indicated on the Drawings are keyed to the Part 3 Glass Schedule Articles at the end of this Section. The Contractor shall confirm the levels of heat-treatment required for each glass type scheduled as contained in "Performance Requirements" and "Quality Assurance" Articles.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide and install watertight and airtight glazing systems capable of withstanding thermal movement and wind and impact loads without failure of any kind, including loss or breakage of glass, failure of seal or gaskets, exudation of glazing sealants, and excessive deterioration of glazing materials.

B. Glass Design: Glass thicknesses and heat treatments indicated are minimum requirements. Glazing details shown are for convenience of detailing only and are to be confirmed by the Contractor relative to cited standards and final framing details. Confirm glass thicknesses and heat treatments, verified by analysis, as required to meet the performance and testing requirements specified in Section 08 44 13 "Glazed Aluminum Curtain Walls," Section 08 41 13 "Aluminum-Framed Entrances and Storefronts," and Section 08 41 26 "All-Glass Entrances and Storefronts."

C. Thermal and Optical Performance Properties: Provide insulating glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For insulating-glass units, properties are based on units with lites 6 mm thick and a nominal 1/2 inch wide interspace.
2. Center-of-Glass U-Values: NFRC 100 methodology using LBL WINDOW 6.3 computer program, expressed as Btu/ sq. ft. x h x deg F.
3. Solar Heat Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL WINDOW 6.3 computer program.
4. Visible Reflectance (Solar Optical) Properties: Center-of-glazing values, according to NFRC 300.

2.3 PRIMARY FLOAT GLASS

A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); Class 1, ultra clear low iron with visible light transmission of not less than 91 percent as indicated in schedules.

1. Ultra Clear, Low Iron Glass: Where indicated in the schedules clear, low iron glass shall mean low iron products as follows:

    a. AGC Asahi Glass Co. Ltd.; Krystal Klear.
    b. Guardian Industries Corp.; UltraWhite.
    c. Pilkington North America; Optiwhite.
    d. Vitro S.A.B. de C.V. "Starphire."

2. In order to reduce the possibility of glass color range rejection, the supplier of float (primary) glass products shall provide glass for the entire Project from a single facility using stockpiled batch run materials from a single source for the entire Project.

3. Float Glass Quality Imperfection Limitations: In addition to the limitations included under ASTM C 1036, all glass shall be supplied meeting the following quality standards:

    a. Point blemishes - seeds/stones with distortion, stain spots, dirt, surface damage - shall be limited to 0.060 inch maximum separated by 12 inchesminimum.
    b. Glass scratch/rubs shall be rejected if detectable at 10 feet.
    c. Water blow-off stains, tag residue, and handprints will not be permitted.

2.4 HEAT-TREATED FLOAT GLASS

A. General: Heat-treat glass where the need is determined by thermal stress analyses, by wind load analyses, and where required to meet safety glazing requirements.

B. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of installed glass unit.

C. Sizes and Cutting: Prior to heat treatment, cut glass to required sizes as determined by accurate measurement of openings to be glazed, making allowance for required edge clearances. Cut and process edges in accordance with glass manufacturer's recommendations. Do not cut or treat edges in the field. Make all cuts for hardware, access, or glass-mounted trim or accessories before heat treating.

D. Heat-Strengthened Glass: Provide glass complying with ASTM C 1048 Kind HS. Surface compression range shall be between 4,000 psi and 7,000 psi for 1/4 inch thick glass. Surface compression range shall be between 5,000 psi (34.5 MPa) and 8,000 psi (55.2 MPa) with an allowable surface compression tolerance of +/- 1,000 psi for 5/16 inch (7.93 mm) thick glass.

    1. Heat-Strengthened Glass Quality Imperfection Limitations: In addition to the limitations included under ASTM C 1048, all glass shall be supplied meeting the following quality standards:

        a. Chill cracks, roller marks, and picture framing shall not be permitted.
        b. Tracking/cloud and heat dimples shall be rejected if detectable at 10 feet.

E. Fully Tempered Glass: Provide glass complying with ASTM C 1048 Kind FT and meeting the requirements of ANSI Z97.1 for Category A performance and 16 CFR 1201 for Category II performance. Surface compression shall be equal to or greater than 10,000 psi. After tempering, heat-soak 100 percent of all fabricated glass units to European Union Standard EN14179 to reduce the potential for inclusion related glass breakage. Statistical heat soaking shall not be permitted.

    1. The appearance of anisotropy, also known as 'leopard spots' • and 'quench patterns', is known to be associated with toughened (tempered) glass under certain polarized lighting conditions. This will not be considered a fault unless it is visible in a range of reasonably typical naturally occurring conditions. The Architect will determine the acceptable range(s) of anisotropy from glass sample submittals. Coatings applied to tempered glass products shall not exacerbate anisotropy to an unacceptable range(s).

2. Tempered Glass Quality Imperfection Limitations: In addition to the limitations included under ASTM C 1048, all glass shall be supplied meeting the following quality standards:

    a. Chill cracks, roller marks, and picture framing shall not be permitted.
    b. Tracking/cloud and heat dimples shall be rejected if detectable at 10 feet.

F. Flatness Tolerances: All heat-treated glass shall be fabricated to the following flatness tolerances. Verification of compliance for overall bow and warp shall be in accordance with ASTM C 1048. Verification of compliance for flatness shall be via an optical scanning device such as LiteSentry or Osprey Series.

1. Overall Bow and Warp: Not greater than the maximum bow and warp tolerances in any direction as listed in ASTM C 1048 Table 2. Localized warp limited to 1/32 inch in 12 inches.
2. Roll Ripple: The deviation from flatness at any peak (peak to valley deviation) shall not exceed 0.003 inches for 6 mmthick glass in the glass center, with leading and trailing edge deviation not to exceed 0.008 inches for 6 mmthick glass.

G. Millidiopter Criteria: Maximum +/- 120 millidiopters overall or the highest overall measurement from the approved visual mockup that is less than +- 120 millidiopter overall whichever is less when viewed outdoors.

2.5 CERAMIC-COATED GLASS

A. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B (spandrel glass, one-surface ceramic coated), Type I (transparent glass, flat), Quality q3 (glazing select), and complying with other requirements indicated in glass schedules.

1. Factory apply opacifier of polyester film laminated to glass with solvent-based adhesive to coated second surface of lites, with resulting products complying with Specification No. 89-1-6 in GANA's "Engineering Standards Manual."

2.6 COATED FLOAT GLASS

A. General: Provide coated glass complying with requirements indicated in this Article, under Paragraph "Insulating Glass," and in schedules.

1. Sputter-Coated Float Glass: Float glass with the coating(s) specified in schedules, deposited by magnetron sputtered vacuum deposition process after manufacture and heat treatment. Post-temperable glass coatings will not be permitted on glass thicknesses of greater than 1/4 inch Pyrolytic, and wet chemical deposition glass coatings will not be permitted.

2. Coating Quality: The allowable range of defects in coatings applied to glass shall be as accepted through glass sample submissions. Installed coated glass products which are outside of the accepted sample range shall be subject to rejection by the Architect. **[In order to reduce the possibility of glass rejection, the supplier of coated glass products shall provide glass coating production runs for the entire Project from a single coating facility.]** All coated glass shall be provided from a single coating facility. The allowable range of defects are defined as follows:

    a. The vision glass area is defined as the field of glass which is greater than 1 inch from the glass unit edge.

        1) Pinholes: At an indoor viewing distance of 10 feetfor non-reflective and reflective low emissivity coatings:

            a) Pinholes greater than 1/16 inchin diameter shall not be permitted in 80 percent of the central portion of the vision glass area and separated by greater than or equal to 12 inches . Pinholes larger than 3/32 inch are not allowed in the outer 20 percent of the perimeter vision glass area and separated by greater than or equal to 12 inches .
            b) No more than two readily apparent blemishes are allowed in a 3 inch diameter circle and no more than five readily apparent blemishes are allowed in a 12 inch diameter circle.

        2) Scratches: At an indoor viewing distance of 10 feetfor non-reflective and reflective low emissivity coatings, and 15 feetfor reflective coatings:

            a) Scratches are allowed in 80 percent of the central glass area if not detectable at the viewing distance, and scratches less than or equal to 1 inch are allowed in the outer 20 percent area if not detectable at the viewing distance. Concentrated scratches or abraded areas are not allowed.
            b) Scuffs, rub marks, cup marks, or abraded areas shall not be permitted in any glass area.

        3) Reflectance and Transmission Inspection: When viewed outdoors against a bright uniform opaque background at a distance of 10 feetfor low emissivity coatings, color, reflectance and transmission will be permitted to have a slight variance subject to Architect's acceptance.

            a) Mottling and streaking of the coating shall not be permitted.
            b) Coating arcing will not be permitted.
            c) Water blow-off stains will not be permitted.
            d) Handprints will not be permitted.
            e) Roller marks shall not be permitted.
            f) Positive and negative air distortion shall not be permitted.
            g) Tag residue shall not be permitted.

3. Edge Deletion Quality Criteria for Coated Glass Layers Used in Insulating Glass Assemblies:

a. Edge deletion of coating to be uniform in appearance (no skips or streaks) and visually straight around the entire perimeter of the glass unit.
b. Edge deletion shall remove a minimum of 95% of the coating.
c. Edge deletion shall be 1/8 inch less than calculated sightline with a tolerance of +/-1/8 inch.
d. Perform sealant adhesion testing to ensure that the secondary and primary sealants yield acceptable adhesion to edge deleted areas of coated glass products.
e. Adhesion testing at the edge deleted area of the coated glass products shall be performed intermittently throughout the days production.
f. Comply with pass/fail requirements of the insulating glass unit manufacturers published guidelines and/or the manufacturers certification audit requirements/recommendations.

2.7 LAMINATED GLASS

A. Laminated Glass: Comply with ASTM C 1172 for kinds of laminated glass indicated and other requirements specified, including those in the Glass Schedule.

B. Interlayer: Unless indicated otherwise, provide 0.060 inch thick polyvinyl butyral (PVB) sheet or ionoplast sheet interlayer material with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.

1. All interlayer furnished for the Project shall have been manufactured by one of the following:

a. Eastman Chemical Company.
b. Kuraray.

C. Laminating Process: Prior to laminating, cut glass to required sizes and profiles as determined by accurate measurement of openings to be glazed, making allowance for required edge clearances. Cut and process edges in accordance with glass manufacturer's recommendations. Do not cut or treat edges in the field. Fabricate laminated glass to produce glass free of scuff vinyl markings, handprints, tag residue, and foreign substances such as lint, hair, vinyl shavings in the central glass area and the outer 20 percent area when viewed from a distance of 39 inches and 10 feet , respectively. Handprints, tag residue, scuff vinyl markings, and foreign substances must be separated by more than 12 inches if not detectable at less than the viewing distances. Delaminations, blow-ins, short interlayers, and air or gas pockets shall not be permitted in the central glass area. In the outer 20 percent area, delamination will not be permitted; blow-ins, air or gas pockets, and short interlayers shall be limited to a maximum dimension of 3/32 inch in diameter, 3/32 inchin diameter, and 1/16 inch long, respectively. Laminate units as follows:

1. Laminate lites with interlayer in autoclave with heat plus pressure.

2.8 INSULATING GLASS

A. Insulating-Glass Units: Preassembled units, with dehydrated entrapped air, consisting of sheets of glass hermetically sealed at all edges with a black polyisobutylene primary and a black silicone secondary elastomeric sealant. The black silicone secondary elastomeric sealant sightlines (width) shall be uniform for each insulating glass unit and, where exposed in 2, 3, and 4 sided wet glazing assemblies, sized for the highest wind pressure in the facade. The lites of glass shall be separated by dessicant containing black colored aluminum spacers. All insulating glass units shall be IGCC certified to comply with ASTM E 2190 and with requirements specified in this Article and in the Glass Schedule.

1. Provide Kind HS (heat-strengthened) float glass where needed to comply with "Performance Requirements" Article. Provide Kind FT (fully tempered) where safety glass is indicated.

B. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Glass Schedule are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

C. Provide the following minimum physical property performance values for the insulating glass unit(s) scheduled:

1. Visible Light Transmittance: 67%.
2. Winter Nighttime U-Value: [**0.28**].
3. Summer Daytime U-Value: [**0.26**].
4. Solar Heat Gain Coefficient: [**0.28**].
5. Outdoor Visible Reflectance: [13**%**].

2.9 FIRE-RATED GLAZING PRODUCTS

A. Laminated Ceramic Glazing Material: Two lites of clear ceramic glazing material laminated together to produce a laminated lite of minimum 5/16 inch nominal thickness; polished on both surfaces; weighing 4 lb/sq. ft.; and as follows:

1. Fire-Protection Rating: As indicated for the assembly in which the glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
2. Polished on both surfaces, transparent.
3. Product: Provide one of the following:

    a. "FireLite Plus"; Nippon Electric Glass Co., Ltd. and distributed by Technical Glass Products.
    b. Schott Pyran Platinum L; McGrory Glass.
    c. Keralite FR-L; Vetrotech.

2.10 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. VOC Content: For architectural sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Gasket, Blocking, and Spacer Wet Glazing Materials: Silicone, compatible with and adherent to each material it will be in contact with, as recommended by the manufacturer to fulfill performance requirements.

C. Structural and Butt Glazing Sealants: Refer to Section 07 92 00 "Joint Sealants," Article "Elastomeric Joint Sealants," subparagraph "Structural Glazing."

D. Glazing Sealant for Fire-Resistive Glazing Products: Identical to product used in test assembly to obtain fire-protection rating.

1. VOC Content: Provide architectural glazing sealants and sealant primers having not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.11 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.12 GLAZING GASKETS

A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C 542, black.

B. Dense Compression Gaskets:

1. Neoprene: Continuous extruded neoprene with, cross sectional profile, physical properties, and tolerances as recommended by the window and curtain wall manufacturer, and as required, to comply with the performance requirements specified and shown all in compliance with the applicable provisions of ASTM C 864, Option II. Provide injection molded corners.
2. EPDM: Continuous extruded EPDM with cross sectional profile, physical properties, and tolerances as recommended by the window and curtain wall manufacturer, and as required, to comply with the performance requirements specified and shown all in compliance with the applicable provisions of ASTM C 864, Option II. Provide injection molded corners.

C. Soft Compression Gaskets: Continuous extruded expanded foam with, cross sectional profile, physical properties, and tolerances as recommended by the window and curtain wall manufacturer, and as required, to comply with the performance requirements specified and shown all in compliance with the applicable provisions of ASTM C 509, Option II, Type II; provide the following:

1. Neoprene.
2. EPDM.

D. Continuous Structural Gaskets/Spacers: Continuous extruded silicone or silicone compatible rubber, with cross sectional profile, physical properties, and tolerances as recommended by the window and curtain wall manufacturer, and as required, to comply with the performance requirements specified and shown. Gaskets/spacers shall be tested for compatibility with silicone sealants and shall be subject to the acceptance of the sealant manufacturer.

2.13 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces, and wet glazing materials, contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: EPDM complying with ASTM C 864 (Option II), blocks, 85 +/- 5 Shore A durometer hardness, 1/16 inch less than the channel width, and length based on the face area of the glass unit to be supported in accordance with GANA standards and glass manufacturer recommendations, but not less than 4 inches.

D. Setting Blocks: Silicone complying with ASTM C 1115 (Type C), blocks, 85 +/- 5 Shore A durometer hardness, 1/16 inch less than the channel width, and length based on the face area of the glass unit to be supported in accordance with GANA standards and glass manufacturer recommendations, but not less than 4 inches.

E. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness of 40 to 60.

F. Edge Blocks: Silicone complying with ASTM C 1115 (Type C), blocks, 65 +/- 5 Shore A durometer hardness, minimum 4 incheslong and sized to allow 1/8 inch clearance between edge of glass and block.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

H. Breakout (Smoke Removal) Window Indicators: Provide indicators as required by Code at tempered glass window units from the second floor to the roof level. Indicators shall be acceptable to the Architect and local authorities having jurisdiction. Apply indicators using methods as recommended by the indicator manufacturer at location(s), in color(s), and in pattern(s), at each window unit as directed by Architect and the local authorities having jurisdiction. All indicators shall be applied to insulating glass units on the No. 2 surface.

2.14 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

1. Edge and Surface Conditions: Comply with the recommendations of AAMA "Structural Properties of Glass" for "clean-cut" edges, except comply with manufacturer's recommendations when they are at variance therewith.
2. Exposed Glass Edges and Surface Condition: All edges shall be flat with an arrissed edge profile (small bevel of uniform width not exceeding 1/16 inch at an angle of approximately 45 degrees to the surface of the glass) with a polished (surface is reflective in appearance similar to the major surface of the glass) surface.

B. Cutting: Do not nip glass edges. Edges may be wheel cut or sawed and seamed at manufacturer's option. For glass to be cut at site, provide glass 2 inches larger than required in both dimensions, so as to facilitate cutting of clean cut edges without the necessity of seaming or nipping. Do not cut, seam, nip or abrade heat-treated glass.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine glass framing, with glazier and glass framing erector present, for compliance with the following:

1. Compliance with the specified manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.

4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing stops, glazing channels, and rabbets which will be in contact with the glazing materials immediately before glazing. Loose particles present or resulting from fabrication and cleaning shall be removed by blowing out joints with oil-free compressed air, or by vacuuming joints. Remove protective coatings, oils from cutting and drilling operations, and residue on metallic surfaces with solvents that leave no residue. Do not allow solvent to air dry without wiping. Use only lint-free towels for wiping of surfaces. Wipe metal surfaces with IPA (isopropyl alcohol) unless otherwise required by compatibility and adhesion testing results.

1. Prime surfaces to receive glazing compounds. When priming, comply with wet glazing manufacturer's recommendations.

B. Inspect each glass unit immediately before installation. Do not install any units which are improperly sized or have damaged edges, scratches or abrasion or other evidence of damage. Remove labels from glass immediately after installation.

C. Seal vent (breather or capillary) tubes in insulating glass units in accordance with the insulating glass manufacturer's written recommendations.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

1. All glass units shall be installed in accordance with the glass manufacturer's recommendations.

a. Unitized Shop-Glazed Structural Silicone Window and Curtain Wall Systems: Comply with the recommendations of the structural silicone and curtain wall framing manufacturers; where conflicts arise, the most stringent shall apply.

1) Structurally seal glass unit to mullions with specified two-part structural silicone sealant. Place and tool structural silicone beads to remove air pockets and bubbles; remove excess structural silicone from glass and metal substrates. Insert and shape weatherseal joint backer rods, or gaskets, into void between glass units and between glass units and framing to the proper depth to receive silicone weatherseal sealant. Place silicone weatherseal sealant into void and tool flush with adjacent exterior glass lite faces; remove excess sealant from glass and metal substrates.

b. Field Glazed Structural Silicone Window and Curtain Wall Units: Set full height continuous structural gaskets/spacers to vertical mullions. Set glass units with void between edge of units and head/sill channel, but with units fully within head/sill rebate so as to provide a proper bite. Align glass unit edges over vertical mullion continuous structural gasket/spacers and secure with manufacturer's recommended temporary cleats. Structurally seal glass unit to vertical mullions with specified one-part structural silicone sealant. Tool structural silicone flush in alignment to mullion face and perpendicular to face of interior glass lite; remove excess structural silicone from glass and metal substrates. After full cure of structural silicone sealant, remove temporary cleats. Any holes left in the vertical mullions which were caused by the temporary cleats shall be sealed immediately. Insert and shape weatherseal joint backer rods, or gaskets, into vertical void between glass units and at a proper depth to receive silicone weatherseal sealant. Place silicone weatherseal sealant into void and tool flush with adjacent exterior glass lite faces; remove excess sealant from glass and metal substrates.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to surfaces indicated to receive glazing materials. Use primers as determined by preconstruction compatibility and adhesion testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless more stringent requirements are recommended by glass manufacturer. Place blocks to allow water passage to weep holes. Set blocks in thin course of silicone sealant.

1. For Glass Units Less Than 72 inches: Locate setting blocks at sill one-quarter of the width in from each end of the glass, unless otherwise recommended by the glass manufacturer.
2. For Glass Units 72 inchesor Greater: Locate setting blocks at sill one-eighth of the width in from each end of the glass, but not less than 6 inches, unless otherwise recommended by the glass manufacturer.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where the length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking to prevent glass lites from moving sideways in glazing channel, sized and located to comply with the glass manufacturer's recommendations and the requirements in referenced glazing publications.

1. Edge blocking will not be required at structural glazed window and curtain walls unless specifically required by the glass manufacturer for the conditions shown.

I. Set glass lites with uniform pattern, draw, bow, and similar characteristics, producing the greatest possible degree of uniformity in appearance on the entire exterior wall elevation.

1. Set glass units with void between edge of units and glazing channel.
2. Shadow Box Enclosure Glazing: Remove any dirt, window and curtain wall debris, and construction debris, from interior portion of shadowbox enclosures. Where lubricants are recommended for the installation of glazing gaskets, use types which will not release volatiles, or leave visible deposits or residues, on inside of spandrel glass units or metal back panels.
3. Orient and install insulating glass units made up with one lite of low emissivity coated glass with the uncoated glass lite on the inboard (building) side.
4. Orient and install insulating glass units made up with one lite of tinted glass with the untinted glass lite on the inboard (building) side.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Miter cut gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away and join with sealant recommended by gasket manufacturer which will provide an airtight and watertight seal at the joint.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

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

3.5 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Use special tool to install and remove filler strips; lubricate in accordance with manufacturer's instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.6 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way and from any source, including natural causes, accidents, and vandalism.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

3.7 GLASS SCHEDULE

A. GL-01: Low-E Clear Insulating Glass - Clear, low reflective exterior appearance.

1. Solarban 72 (2) Acuity + Acuity by Vitro Architectural Glass.
2. Performance Values: VLT 67 percent; SHGC 0.28; shading coefficient 0.32; exterior reflectance 13 percent; U-value winter 0.28; U-value summer 0.26.

3. Insulating glass units 1-inch thick and be composed of a 1/4 inch (6 mm) Acuity glass, Solarban 72 solar control (sputtered) on second surface (2) + 1/2 inch (13 mm) air space + 1/4 inch (6 mm) Acuity glass.

B. GL-10: Low-iron (ultraclear) heat strengthened laminated float glass, 1/2 inch thick with 1/4 inch class 1 (ultraclear) outboard light, 0.06 inch thick PVB interlayer, and 1/4 inch class 1(ultraclear) inboard light. Provide distraction film as noted in the drawings.

C. GL-11: 1/4" thick mirrored glass.

D.

E. **END OF SECTION**

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

1.2 PRE-INSTALLATION MEETING

A. Prior to start of each type of gypsum board system, and at the Contractor's direction, meet at the site and review the installation procedures and coordination with other Work. Meeting shall include Contractor, Architect and major material manufacturer, as well as the Installer and other subcontractors whose Work must be coordinated with the gypsum board Work.

1.3 ACTION SUBMITTALS

A. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

B. Samples: Submit full size samples in 12 inch long lengths for each exposed trim accessory indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

B. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

C. Environmental Product Declarations: For the following product types, obtain products with Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025. Industry-wide EPDs must demonstrate that the manufacturer is a member of the publishing body responsible for the product of the EPD.

1. Joint Compound for Interior Gypsum Board.
2. Gypsum Board, Type X.
3. Gypsum Board, Type C.
4. Sound attenuation blankets.

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

1. Install mockups for the following:

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

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. 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. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

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

C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.7 FIELD CONDITIONS

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

B. Installation of gypsum board joint treatments shall not start until the space to receive gypsum board joint treatments is heated to maintain a continuous and uniform temperature of not less than 55 deg F, from one week prior to beginning of joint treatment until joint treatment is completed and thoroughly dry. Ventilation, either natural or supplied by fans, circulators or air conditioning systems shall be provided to remove excess moisture during joint treatment. Temperature requirements may be waived only on recommendation of gypsum board manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."

B. Ceiling and wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 MATERIALS, GENERAL

A. General: For fire rated assemblies, provide materials, including accessories and fasteners produced by one manufacturer, or, when products of more than one manufacturer are used in a rated system, they shall be acceptable to authorities having jurisdiction.

2.3 INTERIOR GYPSUM BOARD

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

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. Continental Building Products/Lafarge North America Inc.

5. National Gypsum Company.
6. PABCO Gypsum.
7. USG Corporation.

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

C. Flexible Gypsum Board for Curved Surfaces: ASTM C 1396/C 1396M, manufactured to bend to fit tight radii and to be more flexible than standard regular-type panels of the same thickness.

1. Thickness: 1/4 inch.
2. Long Edges: Tapered.
3. Location: Apply in double layer at curved assemblies.

D. Moisture and Mold Resistant Board: ASTM C 1396/C 1396M; with moisture- and mold-resistant core and facing surfaces.

1. Core: 5/8 inch.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
4. Location: Interior ceiling surfaces.

2.4 TILE BACKING PANELS

A. Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: ASTM C 1396, with core type and in thickness indicated.
2. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with core type and in thickness indicated. Available products include:

a. G-P Gypsum Corp.; Dens-Shield Tile Backer.
b. National Gypsum Company; GOLD BOND Brand E²XP Tile Backer.
c. USG; Durock Brand Glass-Mat Tile Backerboard.

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

2.5 TRIM ACCESSORIES

A. Interior Steel Trim Accessories: ASTM C 1047; formed metal sheet steel zinc coated by hot-dipped process. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047.

1. Cornerbead: Use at outside corners.
2. LC-Bead with both face and back flanges to receive joint compound; use at exposed panel edges.

3. U-Bead with face and back flanges; face flange formed to be left without application of joint compound: Use where indicated.
4. Curved-Edge Cornerbead: With notched or flexible flanges; use at curved openings.
5. Expansion (Control) Joint: One-piece control joint formed with V-shaped slot, with removable strip covering slot opening. Use where indicated.

B. Aluminum Trim Accessories: Extruded aluminum trim with 1/4 inch diameter holes in fins for attachment to gypsum board or studs; longest lengths available in profiles indicated; primed for finish painting; sized for scheduled gypsum board thickness shown.

2.6 JOINT TREATMENT MATERIALS

A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of the products and joint treatment materials for each application indicated.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.
3. Paperless Gypsum Board: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, flanges of trim accessories, and fasteners, use setting-type taping compound.
3. Second Coat: For filling over tape, beads and fasteners. Use setting-type, sandable topping compound.
4. Third Coat: For finishing over tape, beads and fasteners. Use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Moisture/Mold-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.
2. Cementitious Backer Units: As recommended by manufacturer.

E. Joint Compound for Specialty Boards: As recommended by manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90. One of the following:

1. SHEETROCK Acoustical Sealant; U.S. Gypsum.
2. AC-20 FTR; Pecora.
3. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2. Product: Subject to compliance with requirements, provide one of the following:

    a. Rockwool AFB; Rockwool.
    b. SAFB Blankets; Thermafiber LLC.

E. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Adhesives shall have a VOC content of 50 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board assemblies attach or abut, installed door frames and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS

A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840, GA-216, and the gypsum board manufacturer's recommendations, where standards conflict, the more stringent shall apply. Install specialty gypsum board as specified below except where manufacturer's instructions conflict; follow manufacturer's instructions for specialty performance board to maintain warranty coverage.

B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints or avoid them entirely.

    a. Stagger abutting end joints not less than one framing member in alternate courses of board.
    b. At high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

D. Multilayer Application:

1. On Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

2. On Ceilings: Apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply base layers in same sequence. Apply base layers at right angles to framing members and offset face layer joints one framing member, 16 inches minimum, from parallel base joints, unless otherwise indicated or required by fire-resistance-rated assembly.

E. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

F. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws.

G. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

H. Curved Partitions:

1. Install panels horizontally and unbroken, to the extent possible, across curved surface plus 12 inches long straight sections at ends of curves and tangent to them.
2. Wet gypsum panels on surfaces that will become compressed where curve radius prevents using dry panels. Comply with gypsum board manufacturer's written recommendations for curve radii, wetting methods, stacking panels after wetting, and other preparations that precede installing wetted gypsum panels.
3. On convex sides of partitions, begin installation at one end of curved surface and fasten gypsum panels to studs as they are wrapped around curve. On concave side, start fastening panels to stud at center of curve and work outward to panel ends. Fasten panels to framing with screws spaced 12 inches o.c.
4. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.
5. Allow wetted gypsum panels to dry before applying joint treatment.

I. Tile Backing Panels:

1. Cementitious Backer Unit Application: ANSI A108.11 at showers, where substrates are indicated to receive Tile Units having a Face Dimension of Greater than 8 by 8 inches, and where otherwise indicated.
2. Glass-Mat, Water-Resistant Backing Panel: Install with 1/4 inch gap where panels abut other construction or penetrations.

J. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

K. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions.

L. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

M. Attach gypsum panels to framing provided at openings and cutouts.

N. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Fit gypsum panels around ducts, pipes, and conduits.
2. Where partitions intersect open exterior and interior wall kickers, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by the wall kickers and other structural members; allow 1/4 to 3/8 inch wide joints to install sealant.
3. Where chase walls are shown, provide bracing between parallel rows of studs. Unless otherwise shown, provide gypsum board braces no less than 1/2 inch thick by 12 inches wide and cut to width of chase. Locate at quarter points in wall height between each pair of parallel studs. Fasten with not less than 3 screws at each stud.

O. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4 to 1/2 inch wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

P. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.

Q. Cut openings in gypsum board for electrical outlets, piping and other penetrations. Maintain close tolerances so that edges will be covered by plates and escutcheons. Cut both face and back paper. Do not install electrical outlets back to back on opposing sides of partitions.

R. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.

1. Space screws a maximum of 12 inches o.c. for vertical applications.
2. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.
3. Install fasteners not less than 3/8 inch from ends or edges of gypsum board sheets, spacing fasteners opposite each other on adjacent ends or edges.
4. Begin fastening from center of gypsum board and proceed toward edges and corners.
5. Apply pressure on surface of gypsum board adjacent to fasteners being driven to ensure that gypsum board will be secured tightly to supporting members.

    a. Drive fastener with shank perpendicular to face of board.

b. Drive screws with a power screwdriver as recommended by gypsum board manufacturer. Set heads of screws slightly below surface of paper without cutting paper.

3.3 INSTALLING TRIM ACCESSORIES

A. General: Fasten trim accessories according to manufacturer's written instructions for type, length, and spacing of fasteners.

B. Install corner beads at external corners.

C. Install interior trim accessories where edge of gypsum panels would otherwise be exposed or semiexposed. Provide interior trim accessories with face flange formed to receive joint compound.

D. Install aluminum trim accessories where indicated.

E. Install control joints in locations indicated and where directed by the Architect for visual effect, or if not indicated or directed by the Architect, provide control joints in accordance with ASTM C 840 which is as follows:

1. Where a partition, wall or ceiling traverses a construction joint (expansion, seismic, or building control element) in the base building structure.
2. Where a wall or a partition runs in an uninterrupted straight plane exceeding 30 linear feet.
3. Control joints in interior ceilings with perimeter relief shall be installed so that linear dimensions between control joints do not exceed 50 feet and total area between control joints does not exceed 2500 square feet.
4. Control joints in interior ceilings without perimeter relief shall be installed so that linear dimensions between control joints do not exceed 30 linear feet and total area between control joints does not exceed 900 square feet.
5. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.

3.4 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Apply joint treatment at gypsum board joints, flanges of interior trim and aluminum trim accessories, interior angles, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration and levels of gypsum board finish indicated. Produce surfaces free of tool marks and ridges ready for decoration of type indicated. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Cementitious Backer Units: Finish according to manufacturer's written instructions.

E. Glass-Mat, Water-Resistant Backing Panels: Do not use paper tape and joint compound. Finish according to manufacturer's written instructions.

F. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:

1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile and where indicated.
3. Level 3: Typically not used.
4. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.

3.5 CLEANING AND PROTECTION

A. Clean floors of all gypsum board debris and leave broom clean. Excess material, scaffolding, tools and other equipment are to be removed upon completion of the Work.

B. Provide final protection and maintain conditions that ensure gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

END OF SECTION **09 29 00**

SECTION 09 30 00 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes ceramic, porcelain, quarry, and glass tile.

B. Refer to Division 01 Sections for requirements regarding:

1. LEED credit achievement goals as summarized by the LEED Scorecard attached to Section 01 81 13, 'Sustainable Design Requirements'.
2. Requirements for documentation of LEED credits.
3. Payment application requirements as they relate to LEED documentation requirements.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide floor tiles complying with the following standard and performance requirement.

B. Dynamic Coefficient of Friction (DCOF): For tile installed on walkway surfaces, provide products with the following value as determined by testing identical products by the DCOF AcuTest Method using a BOT 3000E Tribometer machine per ANSI A 137.1/ANSI A 326.3 tested for wet surface condition.

1. Walkway Surfaces: Minimum 0.42.

1.3 ACTION SUBMITTALS

A. Product Data: For each product indicated.

B. Submittals for LEED

1. Completed "LEED Criteria Worksheet," for each component material of the product or assembly used in the installation of Work of this Section. Refer to Division 01, "Sustainable Design Requirements."

2. Credit IEQ 4.xx for VOC Content: Submit product data for VOC content of all products provided under this Section.

a. Provide documentation on supplier's letterhead of the VOC content of each product provided under this Section. Express quantity in g/L or the unit of measurement used in the applicable LEED Reference Guide for that particular type of product.

3. Credit MR 4.xx and Credit ID for Recycled Content:

    a. Weight Component Documentation: For material assemblies or products having recycled content submit documentation indicating the weight of the material assembly or product and the percentages by weight of post-consumer and pre-consumer recycled content of the material assembly or product. The recycled fraction of the material assembly or product will be multiplied by the total cost of the material assembly or product to determine the recycled content value as prescribed by LEED protocol. Document the weight of the material assembly or product and the post-consumer and pre-consumer recycled contents on the letterhead of the supplier of the material assembly or product.

    b. Cost Component Documentation: Provide the material cost for every component that comprises a material assembly or product that is composed of recycled content provided under this Section. Document the material cost on the letterhead of the supplier for each material assembly or product.

4. Credit MR 5.xx and Credit ID for Local/Regional Materials: Provide the location of manufacture and/or final assembly for each locally/regionally extracted, processed, and manufactured material incorporated into the Work. Locally/regionally extracted or processed is defined as materials having their source as a raw material from within a 500 milesradius of the site. Locally/regionally manufactured is defined as materials having been assembled as a finished product within a 500 milesradius of the project site. Assembly does not include on-site assembly, erection or installation of finished components, as in structural steel, miscellaneous iron or systems furniture. For building materials or products shipped in part by rail or water, the total distance to the project shall be determined by weighted average, whereby the portion of the distance transported by rail is divided by 3, the portion of the distance transported by inland waterways is divided by 2, the portion of the distance transported by sea is divided by 15, and added to the portion of the distance transported by any other means other than by rail, inland waterways, sea, or road, provided the total weighted average distance does not exceed 500 miles (800 kilometers).

    a. Location Documentation: Include distance from the location of manufacture and/or final assembly to the project site for each locally/regionally extracted, processed, and manufactured material incorporated into the Work. If only a fraction of the material is extracted and manufactured locally, indicate the percentage by weight. Submit this documentation on the letterhead of the supplier for each locally/regionally extracted, processed, and manufactured material incorporated into the Work.

    b. Cost Documentation: Include a printed statement of cost for each regionally extracted, processed, and manufactured material. Submit this documentation on the letterhead of the supplier for each locally/regionally extracted, processed, and manufactured material incorporated into the Work.

C. Shop Drawings: Submit shop drawings showing the extent of each type of movement joint. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

D. Samples: Submit samples showing full range of color and texture variations expected.

1. Samples for each type, composition, color, and finish of grout.
2. Thresholds in 6-inch lengths, each type.
3. Metal edge strip in 6-inch lengths, each type.

E. Samples: Submit samples showing full range of color and texture variations expected.

1. Full size units of each type, composition, color, and finish of tile.

2. Assembled samples with grouted joints for each color grout and for each type, composition, color, and finish of tile.

3. Metal edge strip trim in 6-inch lengths, each type.

F. Test Reports: Submit test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile products with requirements specified for slip resistance.

G. Maintenance instructions: Submit maintenance instructions for each type of product specified.

H. Master Grade Certificates: Submit master grade certificates for each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

I. Product Certificates: Submit manufacturers certifications for each type of grout and bonding material being provided are suitable for the intended use and meet or exceed the referenced standards and the requirements of this specification..

1.4 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

B. Test Reports: Submit test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile products with requirements specified for slip resistance.

C. Master Grade Certificates: Submit master grade certificates for each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

D. Product Certificates: Submit manufacturer's certifications for each type of grout and bonding material being provided suitable for the intended use and meet or exceed the referenced standards and the requirements of this Specification.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Instructions: Submit maintenance instructions for each type of product specified.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Provide attic stock equal to the following for each type, color, pattern, and size (or fraction thereof) of tile provided for the Project. Supply in manufacture's unopened containers, identified with name, brand type, grade, class and all other qualifying information, to a location where directed by the Owner.

1. Two percent of amount installed but not less than one box.

1.7 QUALITY ASSURANCE

A. Installer: Engage an installer, with a minimum of 5 years of successful commercial tile installations similar in material, design, and scope to that indicated.

B. Source Limitations for Tile: Obtain each tile type from one source or producer, and from same production run, and of consistent quality in appearance and physical properties for each contiguous area.

C. Field-Constructed Sample Installations: Before installing tile, erect sample installations for each form of construction and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build sample installations to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate sample installations on site, in locations and size indicated or, if not shown or indicated, as directed by Architect but not less than 100 sq. ft. area for floors, and not less than 100 sq. ft. area for walls.
2. Retain and maintain sample installations during construction in undisturbed condition as a standard for judging completed unit of Work.

3. Approved sample installations may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PREINSTALLATION MEETING

A. Prior to the installation of tile, and at the Contractor's direction, meet at the Project site to review the material selections, substrate preparations, installation procedures, coordination with other trades, special details and conditions, standard of workmanship, and other pertinent topics related to the Work. The meeting shall include the Owner, Architect, the Contractor, tile installer, tile and setting material manufacturer's representatives, and representatives of other trades or subcontractors affected by the installation.

1.9 DELIVERY STORAGE AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

1.10 FIELD CONDITIONS

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

B. Provide minimum 28 day cure of concrete and concrete masonry units before the installation of the tile work.

C. Ensure cement and plaster rendering has been applied to interior concrete masonry wall surfaces and has been reviewed by the installer for suitability to receive his mortar bedding materials prior to installation of the tile work.

D. Maintain temperatures within range recommended by the mortar and grout manufacturer, but not less than 50 deg F or more than 90 deg F, in spaces during tile setting. After installation maintain temperatures within range recommended by the mortar and grout manufacturer

E. Close spaces to traffic during tile flooring installation.

F. Close spaces to traffic for 72 hours after tile flooring installation.

G. Shade all tile, materials and the work area from direct sunlight during the installation as needed to prevent rapid evaporation caused by excessive heat or wind.

1.11 EXTRA MATERIALS

A. Provide attic stock equal to the following for each type, color, pattern, and size (or fraction thereof) of tile provided for the project. Supply in manufacturer's unopened containers, identified with name, brand type, grade, class and all other qualifying information, to a location where directed by the Owner.

1. 1. 2% of amount installed but not less than one box.

PART 2 - PRODUCTS

2.1 TILE PRODUCTS, GENERAL (TL##)

1. ANSI Ceramic Tile Standard: Provide 'Standard Grade' tile that complies with ANSI A137.1 "Specifications for Ceramic Tile,"ANSI A137.2, "Specifications for Glass Tile," ANSI A137.3, "Specifications for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs" for types, compositions, and other characteristics indicated.Products and Manufacturers: Provide tile matching the Architect's samples which have been selected from the product lines and manufacturers indicated in [**Section 09 06 00 "Schedule for Finishes."**] [**Finish Schedule on Drawings.**]

B. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

C. Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing where applicable.

D. Rectified Tile Edges: Provide all tile units having a face dimension of greater than 8" x 8" with factory rectified edges.

E. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.

F. G2 Green Squared® Certification: Tile products shall comply with sustainable requirements of ANSI A138.1 "Green Squared - American National Standard Specifications for Sustainable Ceramic Tiles, Glass Tiles, and Tile Installation Materials."

2.2 ACCESSORY MATERIALS

A. Thresholds: Fabricate to provide transition between adjacent floor finishes. Bevel edges at 1:2 slope, limit height of bevel to 1/2 inch or less, and finish bevel to match face of threshold.

B. Waterproofing for Toilet Room, Shower and Kitchen Tile Installations:

1. Fabric-Reinforced and Unreinforced Fluid-Applied Product: System consisting of liquid-latex rubber, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), and fabric reinforcement which are compatible with mortar bed specified and complying with ANSI A118.10; one of the following:

    a. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane. which is manufactured in the plant closest to the geographic location of the project.
    b. LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane. which is manufactured in the plant closest to the geographic location of the project.
    c. Ardex; Ardex [**8+9**] [**WPC**] which is manufactured in the plant closest to the geographic location of the project.

2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Crack Isolation Membrane for Tile Installations:

1. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) (ASTM D 3960), and fabric reinforcement which are compatible with mortar bed specified and complying with ANSI A118.12; one of the following:

    a. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane. which is manufactured in the plant closest to the geographic location of the project.
    b. LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane,. which is manufactured in the plant closest to the geographic location of the project.
    c. MAPEI Corporation; Mapelastic AquaDefense, which is manufactured in the plant closest to the geographic location of the project.
    d. Sika; SikaTile - 200 Fracture Guard Rapid with reinforcing fabric.

2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3 SETTING AND GROUTING MATERIALS

A. Manufacturers and Plant Locations: Provide products manufactured in the plant closest to the geographic location of the project.

B. Source Limitations: For each tile installation, obtain compatible formulations of setting and grouting materials and waterproofing materials containing latex or latex additives from a single manufacturer.

C. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.1A and as specified below:

1. Reinforcing Wire Fabric: Galvanized, flat, welded wire fabric, 2-inch by 2-inch by 0.062-inch diameter; comply with ASTM A1064 and ASTM A 82 except for minimum wire size.
2. Latex Additive: Manufacturer's standard styrene-butadiene-rubber water emulsion, serving as replacement for all gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

D. Latex-Portland Cement Mortar (Thin Set):

1. Prepackaged dry-mortar mix combined with dry powder latex additive, the following:

   a. For Thin Set Placed over Slabs on Grade: Complying with ANSI A118.4 and ANSI A118.11, one of the following:

      1) Keraflex Plus Mortar; MAPEI Corporation.
      2) Laticrete 253 Gold; Laticrete International Inc.
      3) Versabond Flex; Custom Building Products.
      4) SikaTile 350 Flex Set; Sika.

   b. For Thin Set Tile Set over Walls**[, Membranes and Over Elevated Slabs]**: Complying with ANSI A118.15, one of the following:

      1) Kerabond Keralastic; MAPEI Corporation.
      2) Laticrete 272 mixed with Laticrete 333 Superflex; Laticrete International Inc.
      3) SikaTile 350 Flex Set; Sika.

2. For wall applications, provide nonsagging mortar.
3. For glass tile applications where a low temperature coating has not been factory applied to the tile, use mortar that will not show through glass tile bodies. For glass tile installations where a low temperature coating has been factory applied follow the glass tile manufacturers written recommendations for mortar selection and application.

E. Dry Set Mortar for Large and Heavy Tile (LHT Mortar): Complying with ANSI A118.4 ET, HT or HTF and ANSI A118.15 HT or HTF:

1. Prepackaged dry-mortar mix combined with additives to minimize slump and facilitate a thicker bond coat, and specifically manufactured and recommended in writing by the mortar and underlayment manufacturer for use in LHT mortar assemblies; one of the following:

   a. Ultraflex LFT Mortar; MAPEI Corporation.
   b. Laticrete 4-XLT; Laticrete International Inc.
   c. SikaTile 475 LHT Premium Set; Sika.

2. For glass tile applications where a low temperature coating has not been factory applied to the tile, use mortar that will not show through glass tile bodies. For glass tile installations where a low temperature coating has been factory applied follow the glass tile manufacturers written recommendations for mortar selection and application.

F. Polymer-Modified Tile Grout (For Typical Applications): Complying with ANSI A118.7 compounded with calcium aluminate cement, non-shrinking, efflorescence free grout. Provide, and stockpile, grout for each exposed color from a single manufactured and packaged batch source for the entire Project.

1. Polymer Type: Dry, redispersible latex/polymer powder form, prepackaged with other dry ingredients, one of the following:

   a. Prism; Custom Building Products.
   b. Permacolor; Laticrete International Inc.
   c. Ultracolor Plus FA; Mapei Corporation.
   d. SikaTile 815 Secure Grout; Sika.
   e. MasterTile 545; Master Builders Solutions.

2. Colors: As selected by Architect from manufacturers standards to match tile being grouted.

2.4 MISCELLANEOUS MATERIALS

A. Joint Sealants:

1. Typical Surfaces: "Mildew-Resistant Silicone Sealant', as specified in Section 07 92 00 "Joint Sealants."
2. Floor Joints: "Two-Part Polyurethane Sealant for Paving Applications," as specified in Section 07 92 00 "Joint Sealants."

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

C. Grout Sealer: Grout manufacturers recommended product for sealing cementitious grout joints and that does not change color or appearance of grout.

D. Underlayment Product for Leveling and Patching Floors indicated to receive Tiles: Latex-modified, cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

1. Either Ultraplan or Novaplan Underlyment; MAPEI Corporation.
2. NXT Level Plus Underlayment; Laticrete International Inc.
3. SikaLevel -325; Sika.

E. Metal Edge Strips for Wall Applications: Metallic, angle or L-shaped, depth to match tile and setting-bed thickness and having an integral provision for anchorage to substrate; aluminum alloy exposed-edge material; furnish in longest lengths available.

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

    a. Blanke Corporation.
    b. Ceramic Tool Company, Inc.
    c. Schluter Systems L.P.

F. Divider, Transition, and Movement Joint Strips:

1. Divider and Transition Strips: Stainless steel shapes and flat bar trims fabricated from ASTM A 666 (for flat bar) and ASTM A 276 (for shapes) Type 304 stainless steel,1/4 inch wide at top edge unless otherwise indicated, depth as required to suit conditions shown and having an integral provision for anchorage to mortar bed or substrate, unless otherwise indicated. Provide NAAMM #4 satin finish at exposed top edge in the long direction, furnish in longest lengths available.
2. Movement Joint Strips: Laminations of extruded aluminum or formed stainless steel angle shapes, depth as required to finish flush with top surface of adjacent tile flooring fields, back to back installed with full height flexible filler to accommodate movement. Control joints shall have either an exposed approximately 5/8 inch wide interlocking continuous top to conceal prefabricated flexible filler or an exposed custom flexible prefabricated filler to accommodate movement. Joint assembly shall have a total movement capability of approximately 1/4 +1/8 inch/-3/32 /inch. Finish of exposed top to be satin. One of the following:

    a. Basis of Design: Emseal Series ESF 16 AL; Emseal Joint Systems, Ltd.
    b. Schluter; Dilex - EDP, fabricated to comply with the specified requirements.
    c. CTC (Ceramic Tool Company); CTC Joint custom fabricated to comply with the specified requirements.

G. Paints and coatings shall comply with VOC content as shown in CALgreen Section 5.504.4.3.

2.5 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions. Add materials and liquid latex additives in accurate proportions. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 PREINSTALLATION MEETING

A. Prior to the installation of tile, and at the Contractor's direction, meet at the project site to review the material selections, substrate preparations, installation procedures, coordination with other trades, special details and conditions, standard of workmanship, and other pertinent topics related to the Work. The meeting shall include the Owner, Architect, the Contractor, tile installer, tile and setting material manufacturer's representatives, the metal stair subcontractor, and representatives of other trades or subcontractors affected by the installation.

3.2 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present.

1. Verify that substrates for setting tile are sound and free of voids, bugholes, rock pockets, honeycombs, and protrusions, and which are dry, clean, free of oil, waxy films, and curing compounds. Grind or scarify concrete substrates to remove existing floor adhesive and mortar residues (if any), laitance, films, sealing and curing compounds if they are determined to be present on the substrate.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in the existing floor substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
4. Do not commence installation of flooring materials until floor substrate is within the following tolerances in all directions. If substrate is not within tolerance, level the substrate using a method and an underlayment product(s) that is compatible with and acceptable to the setting materials manufacturer.

B. Subfloor Surfaces to Receive Thinset and LHT Mortar Setting Beds: +/- 1/8 inch in 10 feet
Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Remove paint, coatings, including curing compounds and other substances that are incompatible with tile-setting materials.

B. Blending: Color blend tiles at Project site before installing.

1. Furnish the same lots, batches, etc. within the same contiguous areas of the site (i.e. corridors on the same floors, common rooms which adjoin each other, etc.).

3.4 INSTALLATION, GENERAL

A. Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" and the TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" that apply to types of setting and grouting materials and to methods indicated.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

1. Glass Tile Cutting: Use a blade suitable for cutting glass which must be constantly kept wet with water. Cut tiles with the colored surface turned upwards. Cutting shall not be carried out near the edges of the individual tiles. Smooth off any sharp edges with sandpaper. Holes can be made with a drill bit specifically recommended for drilling glass with a diameter up to 5/16-inch. Apply water continually while drilling.

D. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area beginning at thresholds. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

E. Finished Surfaces: Unless otherwise accepted in the sample installation(s), if any, finished surfaces shall present a flat, even appearance, free from waver, projections, and depressions.

F. Movement (Contraction, Control, Expansion, and Isolation Joints) Joints: Locate sealant filled movement joints where recommended by the manufacturer of mortar and grout materials, but not less than the requirements of TCNA EJ171 which follows, and as accepted by the Architect. Form movement joints and other sealant-filled joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles. Where movement joints are to be butted, the ends shall touch and align.

1. Spacing Guidelines:

a. 20 to 25 feet in each direction where interior tile work is not exposed to direct sunlight or moisture.
b. 8 to 12 feet in each direction where interior tile work is exposed to direct sunlight and moisture.

c. Where tilework abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, ceilings, and where changes occur in backing materials, but not at drain strainers.
d. In the joint between tiles making up the inside corner of planes.
e. All contraction, control, expansion, isolation, seismic and cold joints in the horizontal structure and vertical surfaces shall continue through the tile surfaces, but not through membranes.
f. Vertical and Horizontal Joints Widths: Widths for quarry tile and paver tile shall be the same as the grout joint but not less than 1/4 inch or the width of the contraction, control, expansion, seismic, isolation joint whichever is greater; widths for ceramic mosaic tile and glazed wall tile shall not be less than 1/8 inch or the width of the control, expansion, seismic, joint whichever is greater.
g. Keep movement joints free from dirt, debris, grout, mortar, and setting bed materials. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

G. Metal Edge Strips: Install where exposed edge of wall tile meets other wall finishes that finish flush with or below face of tile and the manufacturer of the field tile does not manufacture a tile edge transition trim. Where metal edge strips are indicated and full length single units are not available, joints are to be butted, ends shall touch and align.

H. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout sealer manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.5 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.

1. Do not install tile over waterproofing until waterproofing has cured, and at each horizontal installation, has been tested for water tightness. Test waterproofing membrane for watertightness by damming the floor drain, and creating a dam at the perimeter of the waterproofed basin followed by filling the basin with water, marking the height, and verifying the same height after 48 hours. Repair leaks before continuing with the installation of subsequent tile.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

1. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.7 FLOOR TILE INSTALLATION

A. Thinset Tile over Concrete Slabs (Typical): Install in accordance with the mortar manufacturer's recommendations and requirements indicated below for setting bed methods, installation methods related to types of subfloor construction, and grout installation methods and grout types. Where recommendations and methods conflict, the manufacturer's recommendations shall apply.

1. Mortar: Latex-Portland Cement Mortar: ANSI A108.5.
2. Concrete Subfloors, Interior: TCNA F113.

    a. With a trowel, having notches sized as recommended by the mortar manufacturer, comb the surface of the mortar with the notched side of the trowel removing excess mortar. Spread only as much mortar as can be covered in the time limits established by the mortar manufacturer's recommendations.
    b. Wipe the back of each tile, with a damp sponge, to remove all dust or dirt immediately before applying mortar to tiles.
    c. Immediately after wiping tile backs, but prior to placing tile, the mortar shall be troweled to back of tile for 100 percent coverage to thickness of not less than 1/16-inch.
    d. Place tiles onto mortar bed, maintaining 1/8-inch wide joints, and true accurate pattern as shown. Exercise care to quickly remove spillage from faces of tile using damp sponge. Rake out joints to depth required to receive grout as tile units are set.
    e. Prohibit foot and wheel traffic on tiled floors for period of time as recommended by the mortar manufacturer.

3. Grout Installation: Do not begin grouting tiles until they are firmly set and, in no case, in less than 48 hours after they have been installed. Remove spacers, if any, prior to grouting. For typical installations, comply with latex-portland cement: ANSI A108.10. Fill joints of cushion edged tile to the depth of the cushion; fill joints of square edge tile flush with the tile surface. Do not permit mortar, mounting mesh, or spacer material to show through grouted joints. Provide hard finished grout, which is uniform in color, smooth, and without voids, pinholes, or low spots. Tool surfaces with shallow concave profile.

B. Thinset Tile over Waterproof Membrane (Toilet Rooms [**Showers, and at Hotel Bathrooms and Kitchens**]): Install in accordance with the mortar manufacturer's recommendations and requirements indicated below for setting bed methods, installation methods related to types of subfloor construction, and grout installation methods and grout types. Where recommendations and methods conflict, the manufacturer's recommendations shall apply.

1. Mortar: Latex-Portland Cement Mortar: ANSI A108.5.
2. Linear Floor Drain and Shower Pan Installation, Concrete Subfloors, Interior: TCNA B422C for curbless shower pans with integral bonding flanges. Tie outlet pipes to sanitary waste piping in accordance with the written instructions of the drain manufacturer. Prime and apply waterproofing membrane materials to drain pan bodies in accordance with the written instructions of the drain manufacturer.

3. Concrete Subfloors, Interior: TCNA F122 (on ground) and F122A (above ground).

    a. Apply the mortar to waterproofed slab with the flat side of the trowel.
    b. With a trowel, having notches sized as recommended by the mortar manufacturer, comb the surface of the mortar with the notched side of the trowel removing excess mortar. Spread only as much mortar as can be covered in the time limits established by the mortar manufacturer's recommendations.
    c. Wipe the back of each tile, with a damp sponge, to remove all dust or dirt immediately before applying mortar to tiles.
    d. Immediately after wiping tile backs, but prior to placing tile, the mortar shall be troweled to back of tile for 100 percent coverage to thickness of not less than 1/16-inch.
    e. Place tiles onto mortar bed, maintaining 1/8-inch wide joints, and true accurate pattern as shown. Exercise care to quickly remove spillage from faces of tile using damp sponge. Rake out joints to depth required to receive grout as tile units are set.
    f. Prohibit foot and wheel traffic on tiled floors for period of time as recommended by the mortar manufacturer.

4. Grout Installation: Do not begin grouting tiles until they are firmly set and, in no case, in less than 48 hours after they have been installed. Remove spacers, if any, prior to grouting. For typical installations, comply with latex-portland cement: ANSI A108.10[**; grout installation for hotel bathrooms and kitchen installations, epoxy grout: ANSI A108.6**]. Fill joints of cushion edged tile to the depth of the cushion; fill joints of square edge tile flush with the tile surface. Do not permit mortar, mounting mesh, or spacer material to show through grouted joints. Provide hard finished grout, which is uniform in color, smooth, and without voids, pinholes, or low spots. Tool surfaces with shallow concave profile.

C. Thinset Tile over Crack Isolation Membrane: Install in accordance with the mortar manufacturer's recommendations and requirements indicated below for setting bed methods, installation methods related to types of subfloor construction, and grout installation methods and grout types. Where recommendations and methods conflict, the manufacturer's recommendations shall apply.

1. Mortar: Latex-Portland Cement Mortar: ANSI A108.5.
2. Concrete Subfloors, Interior: TCNA F125-Full.

    a. Apply the mortar to crack isolation membrane covered slab with the flat side of the trowel.
    b. With a trowel, having notches sized as recommended by the mortar manufacturer, comb the surface of the mortar with the notched side of the trowel removing excess mortar. Spread only as much mortar as can be covered in the time limits established by the mortar manufacturer's recommendations.
    c. Wipe the back of each tile, with a damp sponge, to remove all dust or dirt immediately before applying mortar to tiles.

d. Immediately after wiping tile backs, but prior to placing tile, the mortar shall be troweled to back of tile for 100 percent coverage to thickness of not less than 1/16-inch.
e. Place tiles onto mortar bed, maintaining 1/8-inch wide joints, and true accurate pattern as shown. Exercise care to quickly remove spillage from faces of tile using damp sponges. Rake out joints to depth required to receive grout as tile units are set.
f. Prohibit foot and wheel traffic on tiled floors for period of time as recommended by the mortar manufacturer.

3. Grout Installation: Do not begin grouting tiles until they are firmly set and, in no case, in less than 48 hours after they have been installed. Remove spacers, if any, prior to grouting. Comply with Latex-portland cement: ANSI A108.10. Fill joints of cushion edged tile to the depth of the cushion; fill joints of square edge tile flush with the tile surface. Do not permit mortar, mounting mesh, or spacer material to show through grouted joints. Provide hard finished grout, which is uniform in color, smooth, and without voids, pinholes, or low spots. Tool surfaces with shallow concave profile.

3.8 WALL TILE INSTALLATION

A. Install in accordance with the mortar manufacturer's recommendations and requirements indicated below for ANSI setting bed methods, TCNA installation methods related to types of construction, and grout ANSI installation methods and grout types. Where recommendations and methods conflict, the manufacturer's recommendations shall apply.

1. Latex Portland Cement Mortar Installation (using specified latex portland cement mortar material): ANSI A108.5.
2. Gypsum Wallboard, Interior (Latex Portland Cement Mortar) Method: TCNA W243, place tiles maintaining 1/8-inch wide joints, and true accurate pattern as shown.
3. Cementitious Backerboard (Latex Portland Cement Mortar) Method: TCNA W244C, place tiles maintaining 1/8-inch wide joints, and true accurate pattern as shown.
4. Grout Installation: Do not begin grouting tiles until they are firmly set and, in no case, in less than 48 hours after they have been installed. Remove spacers, if any, prior to grouting. Comply with Latex-portland cement: ANSI A108.10 **[; grout installation for hotel bathrooms and kitchen installations, epoxy grout: comply with ANSI A108.6]**. Fill joints of cushion edged tile to the depth of the cushion; fill joints of square edge tile flush with the tile surface. Do not permit mortar, mounting mesh, or spacer material to show through grouted joints. Provide hard finished grout, which is uniform in color, smooth, and without voids, pinholes, or low spots. Tool surfaces with shallow concave profile.

B. Large Format Wall Tile Installation: Install in accordance with the applicable provisions of ANSI A108.19, the tile manufacturer's recommendations and requirements indicated below for ANSI setting bed methods, TCNA installation methods related to types of construction, and grout ANSI installation methods and grout types. Where recommendations and methods conflict, the tile manufacturer's recommendations shall apply. Exercise care to quickly remove spillage from faces of tile using damp sponges. Rake out joints to depth required to receive grout as tile units are set.

1. Ceramic Tile Type: Indicated in Finish Schedule as tiles with face size greater than or equal to 11 s.f. (1 sq. m).
2. Latex Portland Cement Mortar Installation (using specified latex portland cement mortar material): ANSI A108.5.
3. Cementitious Backerboard (Latex Portland Cement Mortar) Method: TCNA W244C, place tiles maintaining 1/8-inch wide joints, and true accurate pattern as shown.

    a. Place and attach mechanical edge leveling system to backup substrates using a type of edge leveling system recommended by the tile manufacturer to minimize lippage between panels.
    b. With a trowel, having notches sized as recommended by the mortar manufacturer, place and comb the surface of the mortar on the backerboard substrate with the notched side of the trowel removing excess mortar. Spread only as much mortar as can be covered in the time limits established by the mortar manufacturer's recommendations. Troweled ridges shall be combed in a straight line parallel to the shortest dimension of the tile.
    c. Wipe the back of each tile, with a damp sponge, to remove all dust or dirt immediately before applying mortar to tiles.
    d. Immediately after wiping tile backs, but prior to placing tile, the mortar shall be placed and combed to back of tile with the notched side of the trowel removing excess mortar. Spread only as much mortar as can be covered in the time limits established by the mortar manufacturer's recommendations. Troweled ridges shall be combed in a straight line parallel to the shortest dimension of the tile.
    e. Place mortar covered tiles onto mortar covered backerboard mortar bed, maintaining 1/8-inch wide joints, and true accurate pattern as shown. Firmly press from center of the tile to cause the ridges to flatten out and come together in a void free bed. Lightly tamp the surface of the tile with a hard rubber grout float to ensure good contact, do not use a rubber mallet. Exercise care to quickly remove spillage from faces of tile using damp sponges. Rake out joints to depth required to receive grout as tile units are set. Allow mortar to cure a minimum of 48 hours before grouting.

4. Grout: Do not begin grouting tiles until they are firmly set and, in no case, in less than 48 hours after they have been installed. Remove spacers, if any, prior to grouting. Comply with Latex-portland cement: ANSI A108.10. Fill joints of cushion edged tile to the depth of the cushion; fill joints of square edge tile flush with the tile surface. Do not permit mortar or spacer material to show through grouted joints. Provide hard finished grout, which is uniform in color, smooth, and without voids, pinholes, or low spots. Tool surfaces with shallow concave profile.

3.9 RECESSED ACCESS DOOR PANEL INSTALLATION

A. Install in accordance with the mortar manufacturer's recommendations and requirements indicated below for setting bed methods, installation methods related to types of construction, and grout installation methods and grout types. Where recommendations and methods conflict, the manufacturer's recommendations shall apply. Exercise care to quickly remove spillage from faces of tile using damp sponges. Rake out joints to depth required to receive grout as tile units are set.

1. Latex Portland Cement Mortar Installation (using specified latex portland cement mortar material): ANSI A108.5, applied to access panel manufacturer supplied metal lath welded to panel substrate.
2. Gypsum Wallboard, Interior (Latex Portland Cement Mortar) Method: TCNA W243, place tiles maintaining 1/8-inch wide joints, and true accurate pattern as shown.
3. Grout Installation: Do not begin grouting tile units until they are firmly set and, in no case, in less than 48 hours after they have been installed. Remove spacers, if any, prior to grouting. Comply with Latex-portland cement: ANSI A108.10. Fill joints flush with the tile unit surface. Do not permit mortar to show through grouted joints. Provide hard finished grout, which is uniform in color, smooth, and without voids, pinholes, or low spots. Tool surfaces with shallow concave profile.

3.10 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work. Replace all cracked, chipped, and broken tile units with matching tile units; patched tile units will not be permitted.

C. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

D. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

END OF SECTION 09 30 00

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for ceilings.

B. Refer to Division 01 Sections for requirements regarding:

1. LEED credit achievement goals as summarized by the LEED Scorecard attached to Section 01 81 13, 'Sustainable Design Requirements'.
2. Requirements for documentation of LEED credits.
3. Payment application requirements as they relate to LEED documentation requirements

1.2 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: Submit product data for each type of product indicated.

B. Submittals for LEED:

1. Completed "LEED Criteria Worksheet," for each component material of the product or assembly used in the installation of Work of this Section. Refer to Division 01, "Sustainable Design Requirements."

2. Credit IEQ 4.xx for VOC Content: Submit product data for VOC content of all products provided under this Section.

    a. Provide documentation on supplier's letterhead of the VOC content of each product provided under this Section. Express quantity in g/L or the unit of measurement used in the applicable LEED Reference Guide for that particular type of product.

3. Credit MR 4.xx and Credit ID for Recycled Content:

a. Weight Component Documentation: For material assemblies or products having recycled content submit documentation indicating the weight of the material assembly or product and the percentages by weight of post-consumer and pre-consumer recycled content of the material assembly or product. The recycled fraction of the material assembly or product will be multiplied by the total cost of the material assembly or product to determine the recycled content value as prescribed by LEED protocol. Document the weight of the material assembly or product and the post-consumer and pre-consumer recycled contents on the letterhead of the supplier of the material assembly or product.
b. Cost Component Documentation: Provide the material cost for every component that comprises a material assembly or product that is composed of recycled content provided under this Section. Document the material cost on the letterhead of the supplier for each material assembly or product.

4. Credit MR 5.xx and Credit ID for Local/Regional Materials: Provide the location of manufacture and/or final assembly for each locally/regionally extracted, processed, and manufactured material incorporated into the Work. Locally/regionally extracted or processed is defined as materials having their source as a raw material from within a 500 milesradius of the site. Locally/regionally manufactured is defined as materials having been assembled as a finished product within a 500 milesradius of the project site. Assembly does not include on-site assembly, erection or installation of finished components, as in structural steel, miscellaneous iron or systems furniture. For building materials or products shipped in part by rail or water, the total distance to the project shall be determined by weighted average, whereby the portion of the distance transported by rail is divided by 3, the portion of the distance transported by inland waterways is divided by 2, the portion of the distance transported by sea is divided by 15, and added to the portion of the distance transported by any other means other than by rail, inland waterways, sea, or road, provided the total weighted average distance does not exceed 500 miles (800 kilometers).

a. Location Documentation: Include distance from the location of manufacture and/or final assembly to the project site for each locally/regionally extracted, processed, and manufactured material incorporated into the Work. If only a fraction of the material is extracted and manufactured locally, indicate the percentage by weight. Submit this documentation on the letterhead of the supplier for each locally/regionally extracted, processed, and manufactured material incorporated into the Work.
b. Cost Documentation: Include a printed statement of cost for each regionally extracted, processed, and manufactured material. Submit this documentation on the letterhead of the supplier for each locally/regionally extracted, processed, and manufactured material incorporated into the Work.

C. Shop Drawings: Submit shop drawings of reflected ceiling plans drawn accurately to large scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Patterns of ceiling suspension assembly members with setting out/work points.
2. Method of attaching hangers to building structure.

3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.

D. Samples: Submit samples for each acoustical panel, for each exposed suspension system member, for each exposed molding and trim, and for each color and texture required, prepared on Samples of size indicated below. Samples shall show the full range of color and texture variations to be expected in the final installation.

1. Acoustical Panel: Set of 6-inch square Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch long Samples of each type, finish, and color.

1.4 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish and store at the site where directed, 2 percent of each type of acoustic panel installed in the Project, packaged in manufacturer's unopened cartons and identified as to contents.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer, with not less than 5 years experience in the installation of materials specified, and who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

C. Performance Requirements: In areas where gypsum wallboard partitions are dependent on the ceiling suspension system for lateral support, design and install suspension system components to sustain the imposed load from the completed partition system including a minimum inward and outward pressure of 5 psf normal to the plane of the wall.

D. Ceiling products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of Seismic Zone 4 earthquake motions according to the following:

1. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."

F. Sample Installations: Before installing acoustical panel ceilings, install sample installations for each type of acoustical panel ceiling installation required to demonstrate aesthetic effects and qualities of materials and execution. The sample installation shall be complete in every way and include all attachments to structure, hangers, grids, ceiling panels, moldings and column trims, light fixtures, air outlets and inlets, speakers, sprinklers heads, heat and smoke detectors. Install sample installations to comply with the following requirements, using materials indicated for the completed Work:

1. Size and Location: Provide 250 square foot sample installations in locations as directed by Architect.
2. Demonstrate the proposed range of aesthetic effects and workmanship.
3. Obtain Architect's approval of sample installations before starting work.
4. Maintain sample installations during construction in an undisturbed condition as a standard for judging the completed Work.

G. Approved sample installations may become part of the completed Work if undamaged at time of Substantial Completion.

H. Requirements of Regulatory Agencies: Provide acoustical ceiling components and assemblies which have been approved for installation in the City of New York. Comply with the applicable provisions of Referenced Standard RS 5-16 of the NYC Building Code.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until wet work (painting, drywall, interior tilework, and concrete leveling) in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. |COORDINATION

1. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

C. EXTRA MATERIALS

1. Furnish and store at the site where directed, 2% of each type of acoustic panel installed in the Project, packaged in manufacturer's unopened cartons and identified as to contents.

PART 2 - PRODUCTS

2.1 METAL SUSPENSION SYSTEMS

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

2. Edge Condition of Cross Runners: Unless otherwise indicated, provide mitered type cross runner to main tee runner intersections. Coordinate locations of notches in the main tees with adjacent ceiling, light, and diffuser modules to effect a notch free condition where cross tees are not indicated to intersect with the main tee.

B. Overhead Deck Hanger Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

1. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with eyepins, clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling assembly.

C. Hangers: As follows:

1. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

    a. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 12 gage (0.106-inch) diameter wire.

2. Rod Hangers: ASTM A 510, mild carbon steel.

    a. Diameter: 1/4-inch.
    b. Protective Coating: ASTM A 153/A 153M, hot-dip galvanized.

3. Flat Hangers: Commercial-sheet steel, ASTM A 653/A 653M, G60, hot dip galvanized.

    a. Size: 1 by 3/16 inch by length indicated.

D. Carrying Channels: ASTM C 754, cold rolled steel channels, 1-1/2-inch, 475 pounds per 1000 feet.

E. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners; provide in longest standard single piece lengths.

1. Shadow (Stepped Moldings): Stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member. Form from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
2. F Moldings: Provide F moldings at ceiling breaks, soffits, bulkheads, and changes in elevation other than vertical walls and columns to the extent indicated. Form from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
3. Metal Perimeter Channel Trim: Shapes and profiles to suit conditions indicated; fabricated from extruded aluminum; finished to match exposed flanges of suspension system runners. Provide manufacturer's recommended tee-bar connection clips, and hanging clips, which lock into specially designed bosses on the channel trim and are screw attached to the web of the intersecting suspension system members. Join sections of trim together with manufacturer's standard splice plates and alignment clips.
4. Perimeter Wing Trim: Shapes and profiles to suit conditions indicated; fabricated from and finished to match exposed panel. Provide manufacturer's recommended connect wing cantilevers, connect splines, connect hooks, connect multi-connection, and installation screws suitable for installation indicated.

F. Clips: Provide support clips, clamps, fasteners, splines, and other attachment devices as required to align components and to connect components and transfer imposed loads of suspension system.

1. Provide partition attachment clips, and fasteners for areas where partition ceiling runners are secured to the ceiling suspension system.
2. Provide attachment clips for runner to angle molding to avoid use of pop rivets.
3. Provide light fixture clips.
4. Provide hold down clips at entryways to reduce flutter as required.
5. Provide miter closure clips.

G. Manufacturers and Products: Refer to drawings and schedules for extent and types of each metal suspension system required.

H. Subject to requirements, provide scheduled suspension systems, or comparable products, acceptable to the Architect, by one of the following:

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Chicago Metallic Corporation.
4. United States Gypsum Company.

2.2 ACOUSTICAL PANELS (CL##)

A. Manufacturers and Products: Refer to drawings and schedules for extent and types of each acoustical panel required.

B. Subject to requirements, provide scheduled acoustical panels, or comparable products, acceptable to the Architect, by one of the following:

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Chicago Metallic Corporation.
4. Rockfon (Roxul Inc.).
5. United States Gypsum Company.

C. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

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

2.3 ACCESSORIES

A. Sealant:

1. Sealant shall have a VOC content of 250 g/L or less.

2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation, anchorage, with requirements for installation tolerances, and other conditions affecting performance of acoustical panel ceilings.

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

3.2 PREPARATION

A. Layout the Work to center board pattern both directions around Work points shown in each major space or room as shown on the Drawings or directed and, where possible, adjust pattern so that edge pieces will be not less than 1/2 unit in width.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook," and as required to match the accepted sample installation.

B. Suspend ceiling hangers as follows:

1. Fasten hangers to anchors that extend into decks. Space hangers not more than 48 inches long each member supported directly from hangers; and provide hangers not more than 6 inches from ends of each member. Provide additional hangers for support of fixtures and other items including but not limited to light fixtures and diffusers, as required to prevent overloading of deck attachment, eccentric deflection or rotation of supporting runners.
2. Hangers:

    a. Secure wire hangers to ceiling suspension members and to supports above with a minimum of 3 tight turns. Connect hangers directly to drilled in anchors (eye screws), or other devices that are secure, and are appropriate for substrate.
    b. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to drilled in anchors, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved.

3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of the supporting structure or of the ceiling suspension system.
5. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Typical Edge Molding Attachment: Align moldings accurately and screw attach securely to substrate with concealed fasteners at intervals not more than 16 inches on center and not more than 3 inches from ends, leveling with ceiling suspension system. Miter corners accurately and connect securely.

    a. Do not use exposed fasteners, including pop rivets, on moldings and trim.

2. Window and Curtain Wall Frame Head Attachment: Unless otherwise indicated, align moldings accurately and secure to window and curtain wall frame heads using manufacturer's recommended double-sided foam white tape, leveling with ceiling suspension system. Miter corners accurately and adhere securely.

    a. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system runners so they are square and securely interlocked with one another. Clip runners to angle moldings do not use exposed fasteners. Finish to lines and levels shown, with maximum deflection not to exceed 1/360 of the span between supports. Laser level accurately in all directions, leveling to a tolerance of 1/8-inch noncumulative. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Run grain of units in one direction as accepted on shop drawings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
3. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using sealer and coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 FIELD QUALITY CONTROL

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

1. Compliance of seismic design.

B. Testing Agency: [**Owner will engage**] [**Engage**] a qualified testing agency to perform tests and inspections and prepare test reports.

C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.

1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.

a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

SECTION 09 61 23 - CONCRETE FLOORING TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes concrete sealing compound for the following applications:

1. [**New**] [**Existing**] concrete floor to remain exposed.
2. [**Concrete floor surfaces directly beneath access flooring.**]

B. Related Requirements:

1. Section [**03 30 00 "Cast-in-Place Concrete"**] [**03 30 53 "Miscellaneous Cast-in-Place Concrete"**] for curing and hardening products for new concrete Work
2. Section 09 61 29 "Concrete Processing" for concrete floors scheduled to receive polished finishes.

1.2 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's specifications, VOC content, application instructions, and general recommendations. Include data substantiating that products to be furnished comply with requirements of the contract documents.

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. CALgreen Submittals:

1. Product Data for Section 5.504.4.3: For architectural paints and coatings, provide documentation including printed statement of VOC content showing compliance with Table 1 of the ARB, Architectural Coatings Suggested Control Measure, unless more stringent local limits apply.
2. Product Data for Section 5.504.4.3.1: Aerosol paints and coatings, provide documentation that products meet the PWMIR Limits for ROC in Section 94522 (a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, in Section 94522(c)(2 and (d)(2) of CCR Title 17.
3. [**Product Data for Section 5.504.4.3.1: In areas under the jurisdiction of the BAAQMD, provide documentation that products comply with the percent VOC by weight of product limits of BAAQMD Regulation 8 Rule 49, "Aerosol Paint Products."**]

4. [**Product Certificates for Section A5.405.1: For products and materials required to comply with requirements for regional materials, provide certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. For the purposes of this requirement, "regional" is interpreted to mean within 500 miles of the project location or within the State of California.**]

1.3 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: Submit manufacturer's instructions for proper maintenance materials and procedures.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Accessibility Requirements: Comply with applicable provisions of the following:

a. U.S. Architectural and Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities (ADAAG).
b. [**ICC/ANSI A117.1 Accessible and Useable Building and Facilities**] **<Insert applicable local code>**.

B. Manufacturer Qualifications: Provide products produced by a company that has successfully specialized in production of this type of work for not less than 5 years.

C. Mockups: Apply mockups of each concrete flooring treatment indicated and each color and finish selected to verify color selection and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each concrete flooring treatment specified in Part 2.

a. Provide samples of at least 48 by 48 inches square.

2. Final approval of color selections will be based on mockups.

    a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

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

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels.

B. Store materials in a clean, dry location protected from exposure to direct sunlight. In storage areas, maintain environmental conditions within range recommended in writing by manufacturer.

1.7 FIELD CONDITIONS

A. Environmental Requirements: Do not proceed with installation until areas to receive the work have been enclosed and until temperature and relative humidity have been stabilized and will be maintained within values established by the manufacturer for optimum quality control.

B. Environmental Limitations: Comply with coating manufacturer's written instructions for substrate temperature, ambient temperature, humidity, ventilation, and conditions affecting floor treatment application. Do not apply coating until wet work in spaces is complete and dry; and overhead work, including installation of [**athletic equipment,**] mechanical systems, and lighting is complete.

    1. Apply floor coatings when substrate temperature and surrounding air temperatures are between 50 deg F and 95 deg F.

C. Do not apply floor coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

D. Ventilation: Provide adequate ventilation to prevent accumulation of hazardous fumes, if any, during application of concrete floor sealer in enclosed spaces, and maintain ventilation until sealer has cured.

PART 2 - PRODUCTS

2.1 SEALING COMPOUND

A. Clear, Waterborne, Membrane-Forming Sealing Compound: ASTM C 1315, Type 1, Class A or B.

1. Products: Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

    a. Master Builder Solutions by BASF; MasterKure HD 100WB.
    b. Master Builder Solutions by BASF; MasterKure HD 200WB.
    c. The Euclid Chemical Company; Diamond Clear VOX.
    d. QC Construction Products; QC VOC 100 WB
    e. Insert additional manufacturer; product.

2. VOC Content: Sealing compounds shall have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Sealing compounds shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
4. Paints and coatings shall comply with VOC content as shown in CALgreen Section 5.504.4.3.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for conditions affecting performance and conditions of floor treatment with requirements for maximum moisture content. Verify concrete slabs are flat, level, and dry.

1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter for concrete: 12 percent.
2. Verify compatibility with and suitability of substrates, including existing finishes or primers. [**Verify if plasticizers in existing concrete substrate will not impair bond.]**
3. Perform tests recommended by manufacturer. Proceed with installation after substrates pass testing.
4. Commence coating application after unsatisfactory conditions are corrected and surfaces are dry.
5. Commencement of floor treatment application indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Clean substrate, removing projections and substances detrimental to the work; comply with recommendations of manufacturer for preparation procedures. Mask off or protect adjacent surfaces not scheduled to receive sealer.

B. Concrete Substrates: Prepare and clean substrates according to manufacturer's written instructions.

1. Clean substrates of substances that impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants. [**Neutralize plasticizers that cannot be removed.]**
2. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
3. Remove incompatible primers and reprime substrate with compatible primers as required
4. Remove laitance, glaze, curing compounds, form release agents, dust, dirt, grease, oil, and contaminants that impair bond. Remove contaminants using mechanical means.
5. Treat nonmoving substrate cracks and control joints to prevent cracks from telegraphing (reflecting) through flooring according to manufacturer's written recommendations.
6. Protect substrate voids and joints to prevent flooring resins from flowing into or leaking through them.

C. Protect walls, floor openings, equipment inserts, electrical openings, door frames, and obstructions during installation. Cover floor and wall areas at mixing stations.

3.3 APPLICATION

A. General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where Project conditions require extra precautions or provisions to ensure satisfactory performance of the Work.

B. Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.4 CLEANING

A. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or appropriate methods for coating. Do not scratch or damage adjacent finished surfaces.

3.5 PROTECTION

A. Institute protective procedures and install protective materials as required to ensure that work is without damage or deterioration at substantial completion. Protect adjacent work against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

B. At completion of construction activities and before Substantial Completion, touch up and restore damaged or defaced coated surfaces.

END OF SECTION 09 61 23

SECTION 09 61 43 - VAPOR-CONTROL FLOORING TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Liquid-applied penetrating vapor control system for [**new concrete slab**] [**existing concrete slab-on-grade**] substrates to receive adhesive applied floor coverings where on-site moisture vapor transmission exceeds the limitations of the floor covering manufacturer's published recommendations. Provide a complete vapor control system including all items necessary, even if not specifically noted.

B. Related Requirements:

1. Division 09 Sections for scheduled finish flooring.

1.2 PRICE AND PAYMENT PROCEDURES

A. Allowances: Refer to Section 01 21 00 "Allowances" for description of Work in this Section affected by allowances.

B. Unit Prices: Refer to Section 01 22 00 "Unit Prices" for description of Work in this Section affected by unit prices.

1.3 DEFINITIONS

A. pH: Used in this Section to mean "alkalinity" as described in ASTM F 710.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including but not limited to the following:

1. Data to indicate compliance with specified requirements.
2. List of system use and performance history, for the same formulation and system design, listing reference sources for a minimum of 15 years.

3. Manufacturer's recommended installation procedures, including the basis for accepting or rejecting actual installation procedures used on the Project.

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

1.6 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

B. Manufacturer Certificates: Manufacturer's certificate that certifies acceptance and exposure to continuous topical water exposure after final cure.

C. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

D. Material Test Reports: Independent test results indicating compliance with the performance requirements.

E. Moisture Testing Reports: Field test results of moisture testing prior to application.

F. Field Quality-Control Report: Manufacturer's field reports indicating full compliance by the installer of the specified system and that the system was in full compliance with all requirements of this Section.

G. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Applicator's Qualifications: Engage an experienced Installer, approved and certified in writing by the manufacturer as qualified to install treatment in accordance with manufacturer's warranty requirements.

B. Manufacturer's Qualifications: Formulates synthetic type treatments for vapor emission and alkalinity control installations of similar size and complexity with the system proposed for use.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Store materials in a dry, secure area protected from exposure to harmful weather conditions and at temperature levels as recommended by manufacturer.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Comply with vapor-control flooring treatment manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting vapor-control flooring treatment application.

B. Do not install vapor-control flooring treatment until installation areas are enclosed and conditioned.

1. Do not apply vapor-control flooring treatment to unprotected surfaces, or when water is accumulated on the surface of the concrete.
2. Do not apply vapor-control flooring treatment when temperature is lower than, 50 deg F or expected to fall below this temperature within 24 hours from time of application.
3. Allow continuous ventilation and indirect air movement at all times during application and curing process of treatment.

C. Close spaces to traffic during vapor-control flooring treatment application and for not less than 24 hours after application unless manufacturer recommends a longer period.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which [**manufacturer**] [**and**] [**Applicator**] agree(s) to repair or replace materials that fail in material or workmanship specified in "Performance Requirements" Article within specified warranty period.

1. In the event moisture vapor emission rates exceed specified requirement during warranty period and cause flooring system damage, manufacturer and installer shall provide complete repair and replacement of damage flooring at no cost to Owner. Repair shall include new flooring, adhesives, patching compounds, required accessories and labor charges to provide an acceptable, Owner-approved flooring system.

    a. Warranty shall not exclude concrete silicates, ACI documents, or curing treatments.

2. Applicator shall warrant that installed system is compatible with specified flooring, and specified floor coverings require no additional cementitious materials, special adhesives or reapplications of system components at additional charge to Owner. Finish flooring installation shall remain standard for all specified flooring.

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

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. General: Non-corrosive, non-toxic, non-flammable, non-combustible and not labeled as a marine pollutant in liquid or mixed form.

B. Source Limitations: Obtain components and accessories of concrete moisture-vapor control system through one source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide proprietary, synthetic polymer capable of penetrating concrete surfaces and forming a dense, non-removable, seamless membrane to reduce water vapor emissions levels and alkali salts, avoid water vapor damage to other adhered systems, and resistant to most commonly encountered acids/solvents in case of topical spills.

B. Application of treatment shall reduce water vapor emission to 2 lb of water/1000 sq. ft. in 24 hrs per ASTM F 1869, remain resistant to alkaline pH levels of 14 per ASTM F 710, and resistant to finish flooring delamination.

C. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Water Vapor Transmission (Wet Method): 95 percent vapor reduction compared to untreated ACI Committee 201 durable concrete samples per ASTM E 96.
2. Chemical Resistance, 14pH: 100 percent tolerant, 30 day exposure per ASTM D 1308.
3. Adhesion Strength: 100 percent concrete cohesive failure per ASTM D 4541.
4. Post Moisture Testing Results: Capable of controlling 42.0 lbs to 2.0 lbs of water/1,000 sq. ft in 24 hr per ASTM F 1869.
5. Chemical Resistance, 30 days: Tolerant to 35 percent potassium hydroxide per ASTM D 1308.
6. In-Situ Relative Humidity: Tolerant to 100 percent exposure per ASTM F 2170.

D. Regulatory Requirements: Conform to regulation of California Air Resource Board and local air quality/air pollution control district regarding VOC content.

2.3 VAPOR-CONTROL MEMBRANE

A. Vapor-Control Membrane: Two-component, multi-coat application of a breathable fluid-applied membrane compatible with types of floor covering products indicated; no system failures due to improper installations, and contain no water/alkaline soluble compounds.

1. Products: Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

a. Diamond Stone Products, Inc.; Diamond-VRS.
b. Floor Seal Technology, Inc.; System 6.
c. Koester VAP 1 2000; Koester American Corporation.
d. Synthetics International; Synthetic 30

B. Primers: Non-porous primer for securing cement topcoat products recommended by vapor control membrane manufacturer and compatible with underlayment and membrane.

C. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Low-Emitting Materials: Liquid floor treatments shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to preparation of the Work under this Section, examine installed Work executed under other Sections which affect execution of work under this Section.

B. Moisture Testing Procedures: Perform the following tests to determine if vapor-control flooring treatment is required.

1. Testing Conditions: Do not conduct moisture testing until final building environmental conditions have been achieved. Maintain temperature between 65 to 85 deg F and relative humidity between 40 to 60 percent for not less than 72 hours prior to and throughout duration of testing.
2. Perform concrete testing to determine conditions at a minimum of three tests for the 1000 sq. ft. and one additional test for each 1000 sq. ft. thereafter for each of the following methods:

a. Water Vapor Transmission: Not to exceed 3 lb of water/1000 sq. ft. in 24 hours per ASTM F 1869.
b. Internal Relative Humidity: Not to exceed 75 percent RH per ASTM F 2170.
c. Digital Alkalinity-pH: Not to exceed 9.0 pH per ASTM F 2170.
d. Provide test results with map of test locations and recommendations to the Architect prior to installation of finish flooring.

C. Upon receipt of written approval from Architect to proceed with Work specified in this Section, examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements
2. Inspect for previously applied treatments that may inhibit penetration or performance of vapor control flooring treatment.
3. Verify that required repairs are complete, cured, and dry before applying treatment.
4. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate work under this Section with Work specified under other Sections to ensure proper and adequate interface of Work.

B. Protect adjacent surfaces from drips, spray, damage to walls and base, air pollution of surrounding environment, and other damage from work under this Section.

C. Surface Preparation:

1. Investigate and inform the treatment manufacturer if concrete additives such as chlorides, plasticizers, or other soluble compounds that can contaminate surfaces have been used in concrete mix.
2. Before application of flooring treatment, clean substrate of substances that could impair penetration or performance of product according to flooring treatment manufacturer's written instructions.
3. Shotblast floors, using #420 shot, to remove defective materials and foreign matter such as dust, adhesives, leveling compounds, paint marks, dirt, floor hardeners, paint overspray, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, moisture testing adhesives and steel shot.
4. Repair cracks, expansion joint, control joints, and open surface honeycombs and fill in accordance with manufacturer's recommendations.
5. Provide an uncontaminated, absorptive, sound surface. Do not acid etch.
6. Vacuum surfaces clean prior to application. Do not use clean sweeping agents, dust absorbers or chemical agents to clean concrete.

3.3 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of flooring treatment and to instruct Applicator on the product and application method to be used.

B. Apply in accordance with manufacturer's instructions and recommendations, unless specifically noted otherwise.

1. Comply with regulatory requirements.
2. Close areas to traffic during application and for time period after application recommended in writing by manufacturer.

C. Apply treatment with manufacturer's representative present.

D. Cure treatment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

E. Do not install floor coverings over treatment until after time period recommended in writing by vapor-control flooring treatment manufacturer.

3.4 FIELD QUALITY CONTROL

A. Testing and Inspection: [**Engage**] [**Owner will engage**] a qualified testing and inspection agency to perform the following:

1. Schedule inspections and notify the Architect, [**Project Inspector,**] and other regulatory agencies, if any, of the time at least 48 hours prior to the inspection.
2. Validation Testing:

a. After application of the treatment, test interior concrete floor surfaces scheduled to receive the vapor-control flooring treatment to establish system performance.
b. Testing agency to provide validation calcium chloride testing of treated floor areas designated in accordance with ASTM F 1869 once the specified system has been installed.

1) At a minimum, test interior slab-on-grade surfaces prior to finish flooring installation and after the spaces to receive finish flooring are brought to an environmental condition matching the designated conditions of use.
2) Provide test kits at the rate of three kits per 1000 sq. ft. and one additional test kit for each additional 1000 sq. ft. or portion thereof; and for validation testing, provide one test kit placed beside every sixth test kit.

c. Digital Alkalinity pH Testing: Testing agency shall conduct pH test at each calcium chloride test.

d. Vapor emission test readings shall satisfy the manufacturer's published requirements of the finish flooring to be installed. Common acceptable criteria require that vapor emissions not exceed 3 lb of water/1000 sq. ft. in 24 hours, although various manufacturers' actual requirements may vary.
e. Once test results are known, copies shall be given to Architect, Contractor, and Owner.

B. If the validation test vapor emission and pH readings exceed the requirements of the finish flooring manufacturer, provide remedial materials and labor, at no additional cost to the Owner, to bring vapor emissions and pH within acceptable limits.

3.5 CLEANING AND PROTECTION

A. Immediately clean vapor-control flooring treatment from adjoining surfaces and surfaces soiled or damaged by flooring treatment application as work progresses. Correct damage to work of other trades caused by flooring treatment application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

C. Provide finish, clean and ready for the application of finish flooring.

D. Protect each coat during specified cure periods from traffic, topical water, and contaminants.

END OF SECTION 09 61 43

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes resilient wall base and accessories.

B. Refer to Division 01 Sections for requirements regarding:

1. LEED credit achievement goals as summarized by the LEED Scorecard attached to Section 01 81 13, 'Sustainable Design Requirements'

2. Requirements for documentation of LEED credits.

3. Payment application requirements as they relate to LEED documentation requirements.

1.2 SUBMITTALS

A. Product Data: Submit product data for each product indicated.

B. Submittals for LEED:

1. Completed "LEED Criteria Worksheet," for each component material of the product or assembly used in the installation of Work of this Section. Refer to Division 01, "Sustainable Design Requirements."

2. Credit IEQ 4.xx for VOC Content: Submit product data for VOC content of all products provided under this section.

   a. Provide documentation on supplier's letterhead of the VOC content of each product provided under this section. Express quantity in g/L or the unit of measurement used in the applicable LEED Reference Guide for that particular type of product.

3. Credit MR 4.xx and Credit ID for Recycled Content:

   a. Weight Component Documentation: For material assemblies or products having recycled content submit documentation indicating the weight of the material assembly or product and the percentages by weight of post-consumer and pre-consumer recycled content of the material assembly or product. The recycled fraction of the material assembly or product will be multiplied by the total cost of the material assembly or product to determine the recycled content value as prescribed by LEED protocol. Document the weight of the material assembly or product and the post-consumer and pre-consumer recycled contents on the letterhead of the supplier of the material assembly or product.

b. Cost Component Documentation: Provide the material cost for every component that comprises a material assembly or product that is composed of recycled content provided under this section. Document the material cost on the letterhead of the supplier for each material assembly or product.

4. Credit IEQ 4.3 for hard surface flooring: For projects where 25% of the finished floor area other than carpet, the floor finish shall be FloorScore Certified. Non-carpet flooring adhesives (if any) and their finish (if any) shall meet the requirements of IEQ Credit 4.1 and IEQ Credit 4.2 respectively.

5. Credit MR 5.xx and Credit ID for Local/Regional Materials: Provide the location of manufacture and/or final assembly for each locally/regionally extracted, processed, and manufactured material incorporated into the work. Locally/regionally extracted or processed is defined as materials having their source as a raw material from within a 500 milesradius of the site. Locally/regionally manufactured is defined as materials having been assembled as a finished product within a 500 miles radius of the project site. Assembly does not include on-site assembly, erection or installation of finished components, as in structural steel, miscellaneous iron or systems furniture. For building materials or products shipped in part by rail or water, the total distance to the project shall be determined by weighted average, whereby the portion of the distance transported by rail is divided by 3, the portion of the distance transported by inland waterways is divided by 2, the portion of the distance transported by sea is divided by 15, and added to the portion of the distance transported by any other means other than by rail, inland waterways, sea, or road, provided the total weighted average distance does not exceed 500 miles (800 kilometers).

   a. Location Documentation: Include distance from the location of manufacture and/or final assembly to the project site for each locally/regionally extracted, processed, and manufactured material incorporated into the work. If only a fraction of the material is extracted and manufactured locally, indicate the percentage by weight. Submit this documentation on the letterhead of the supplier for each locally/regionally extracted, processed, and manufactured material incorporated into the work.
   b. Cost Documentation: Include a printed statement of cost for each regionally extracted, processed, and manufactured material. Submit this documentation on the letterhead of the supplier for each locally/regionally extracted, processed, and manufactured material incorporated into the work.
   c. Samples: Submit samples for each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.3 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient wall base and accessories during the following time periods:

1. 48 hours before installation.

2. During installation.

3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

1.4 EXTRA MATERIALS

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

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5

PART 2 - PRODUCTS

2.1 Products and Manufacturers:

A. Refer to the Finish Schedule and the drawings. Nominal thickness not less than 1/8 inch unless greater thickness is scheduled. All resilient base shall be manufactured from rubber complying with ASTM F 1861, Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic), Group I (solid, homogeneous). Provide all resilient wall base in continuous coils to minimize field butt joints. Provide all resilient wall bases with a coved base toe style typically and with straight flat or toeless base style at carpet, unless otherwise indicated on the Finish Schedule on the drawings.

B. Resilient Base: Thermoset rubber Thermoplastic rubber Vinyl, thermoplastic.

1. Style and Location:

a. Straight: In areas with carpet Insert requirements.
b. Cove: In areas with resilient flooring Insert requirements.
c. Butt to: In areas indicated Insert requirements.
d. Sculptured: [**In areas indicated**] <**Insert requirements**>.

2. Minimum Thickness: 0.125 inch 0.080 inch Insert dimension.

3. Height: 2-1/2 inches 4 inches 6 inches As indicated on Drawings.
4. Outside Corners: Job formed Preformed Job formed or preformed.
5. Inside Corners: Job formed Preformed Job formed or preformed.

C. Resilient Accessories: Rubber Vinyl.

1. Stair-tread nosing.
2. Cap for cove carpet.
3. Cap for cove resilient flooring.
4. Carpet bar for tackless installations.
5. Carpet edge for glue-down applications.
6. Nosing for carpet.
7. Nosing for resilient flooring.
8. Reducer strip for resilient flooring.
9. Joiner for tile and carpet.
10. Transition strips.
11. Insert accessory.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Remove paint, sealers, substrate coatings and other substances that are incompatible with adhesives to be used for installing resilient stair accessories using mechanical methods recommended by manufacturer. Do not use solvents.

C. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates indicated to receive resilient stair accessories.

D. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are the same temperature as the space where they are to be installed.

E. Sweep and vacuum clean substrates to be covered by resilient stair accessories products immediately before installation.

3.3 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.

2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Remove adhesive and other blemishes from exposed surfaces.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

    a. Do not wash surfaces until after time period recommended by manufacturer.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION 09 65 13

SECTION 09 65 16 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 |SUMMARY

A. This section includes resilient wall base and accessories.

B. Refer to Division 01 Sections for requirements regarding:

1. LEED credit achievement goals as summarized by the LEED Scorecard attached to Section 01 81 13, 'Sustainable Design Requirements'
2. Requirements for documentation of LEED credits.
3. Payment application requirements as they relate to LEED documentation requirements.

1.2 SUBMITTALS

A. Product Data: Submit product data for each product indicated.

B. Submittals for LEED:

1. Completed "LEED Criteria Worksheet," for each component material of the product or assembly used in the installation of Work of this Section. Refer to Division 01, "Sustainable Design Requirements."
2. Credit IEQ 4.xx for VOC Content: Submit product data for VOC content of all products provided under this section.

    a. Provide documentation on supplier's letterhead of the VOC content of each product provided under this section. Express quantity in g/L or the unit of measurement used in the applicable LEED Reference Guide for that particular type of product.

3. Credit MR 4.xx and Credit ID for Recycled Content:

    a. Weight Component Documentation: For material assemblies or products having recycled content submit documentation indicating the weight of the material assembly or product and the percentages by weight of post-consumer and pre-consumer recycled content of the material assembly or product. The recycled fraction of the material assembly or product will be multiplied by the total cost of the material assembly or product to determine the recycled content value as prescribed by LEED protocol. Document the weight of the material assembly or product and the post-consumer and pre-consumer recycled contents on the letterhead of the supplier of the material assembly or product.

b. Cost Component Documentation: Provide the material cost for every component that comprises a material assembly or product that is composed of recycled content provided under this section. Document the material cost on the letterhead of the supplier for each material assembly or product.

4. Credit IEQ 4.3 for hard surface flooring: For projects where 25% of the finished floor area other than carpet, the floor finish shall be FloorScore Certified. Non-carpet flooring adhesives (if any) and their finish (if any) shall meet the requirements of IEQ Credit 4.1 and IEQ Credit 4.2 respectively.
5. Credit MR 5.xx and Credit ID for Local/Regional Materials: Provide the location of manufacture and/or final assembly for each locally/regionally extracted, processed, and manufactured material incorporated into the work. Locally/regionally extracted or processed is defined as materials having their source as a raw material from within a 500 milesradius of the site. Locally/regionally manufactured is defined as materials having been assembled as a finished product within a 500 miles radius of the project site. Assembly does not include on-site assembly, erection or installation of finished components, as in structural steel, miscellaneous iron or systems furniture. For building materials or products shipped in part by rail or water, the total distance to the project shall be determined by weighted average, whereby the portion of the distance transported by rail is divided by 3, the portion of the distance transported by inland waterways is divided by 2, the portion of the distance transported by sea is divided by 15, and added to the portion of the distance transported by any other means other than by rail, inland waterways, sea, or road, provided the total weighted average distance does not exceed 500 miles (800 kilometers).

    a. Location Documentation: Include distance from the location of manufacture and/or final assembly to the project site for each locally/regionally extracted, processed, and manufactured material incorporated into the work. If only a fraction of the material is extracted and manufactured locally, indicate the percentage by weight. Submit this documentation on the letterhead of the supplier for each locally/regionally extracted, processed, and manufactured material incorporated into the work.
    b. Cost Documentation: Include a printed statement of cost for each regionally extracted, processed, and manufactured material. Submit this documentation on the letterhead of the supplier for each locally/regionally extracted, processed, and manufactured material incorporated into the work.
    c. Samples: Submit samples for each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.3 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient wall base and accessories during the following time periods:

1. 48 hours before installation.

2. During installation.
3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

1.4 EXTRA MATERIALS

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

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 ACTION SUBMITTALS

A. Shop Drawings: Submit shop drawings showing the following:

1. Show locations of seams, details of special patterns, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

B. Samples: Submit samples in manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern of floor covering required.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

1.6 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

B. Field Test Reports: Provide signed field test reports for tests indicated below. Indicate results and test locations. Include manufacturer's recommendations.

1. Anhydrous calcium chloride test results.
2. Relative humidity probe test results.
3. Alkalinity test results.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Engage a qualified installer who employs workers for this Project that are competent in techniques required by the sheet flooring manufacturer for the floor covering installation indicated and whose work has resulted in flooring covering installations with a record of successful in-service performance.

1.9 DELIVERY, STORAGE, AND HANDLING

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

1. Store rolls of sheet floor coverings upright.

1.10 FIELD CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install floor coverings after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. FloorScore Compliance: Resilient sheet flooring shall comply with requirements of FloorScore certification.

B. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 SHEET FLOOR COVERING (RS-)

A. Products and Manufacturers: Refer to Finish Schedule on Drawings.

B. Seaming Method: Standard Heat welded.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based formulation provided or approved by floor covering manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit sheet floor covering and substrate conditions indicated.

1. Use adhesives that have a VOC content of not more than 50 g/L for VCT adhesives and 60 g/L for asphalt tile adhesives when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesives shall have a VOC content of [**50**] [**60**] <**Insert value**> g/L or less.
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Heat-Welding Bead: Solid-strand product of floor covering manufacturer.

1. Color: Match floor covering.

D. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1 inch radius provided or approved by floor covering manufacturer.
2. Cap Strip: Square metal or rubber cap provided or approved by floor covering manufacturer.

E. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of floor coverings, and in maximum available lengths to minimize running joints.

1. Product: Subject to compliance with requirements, provide Schlüter Systems, Jolly-[**MC**] [**ACG**] [**AMG**] [**AM**] [**AC**] [**P**].

F. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor coverings.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of floor coverings.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by flooring manufacturer. Do not use solvents.
3. [**Alkalinity and**]Adhesion Testing: Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than [**9**] [**10**] <**Insert number**> pH.
4. Moisture Testing: Perform tests recommended by flooring manufacturer, but not less stringent than the following:

a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor emission rate of [3 lb of water/1000 sq. ft.] <**Insert rate**> in 24 hours.

b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum [**75**] <**Insert number**> percent relative humidity level.

C. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

D. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install floor coverings until they are same temperature as space where they are to be installed.

E. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.3 INSTALLATION

A. Unroll sheet floor coverings and allow them to stabilize before cutting and fitting.

B. Lay out sheet floor coverings as follows:

1. Maintain uniformity of floor covering direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
3. Match edges of floor coverings for color shading at seams.
4. Avoid cross seams, filler pieces and strips.

C. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

D. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.

F. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

G. Heat-Welded Seams: Comply with the flooring manufacturer's instructions and ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.

H. Integral Flash Cove Base: Cove floor coverings 6 inches up vertical surfaces. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing floor covering installation:

1. Remove adhesive and other blemishes from floor covering surfaces.
2. Sweep and vacuum floor coverings thoroughly.
3. Damp-mop floor coverings to remove marks and soil.
4. Do not wash floor coverings until adhesives have cured unless otherwise recommended by manufacturer.

B. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Do not move heavy and sharp objects directly over floor covering surfaces. Place plywood or hardboard panels over floor coverings and under objects while they are being moved. Slide or roll objects over panels without moving panels.

C. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor covering before applying liquid floor polish.

1. Apply [**one**] [**two**] [**three**] <**Insert requirement**> coat(s).

D. Cover floor coverings until Substantial Completion.

END OF SECTION 09 65 16

SECTION 09 68 13 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes carpet tile.

B. Related Requirements:

1. Section 03 30 00 "Cast-In-Place Concrete" for new concrete slabs to receive tile carpeting.
2. Section 03 54 16 "Hydraulic Cement Underlayment" for patching and leveling of substrates
3. Section 06 10 00 "Rough Carpentry" for wood floors receiving tile carpeting.
4. Section 06 16 00 "Sheathing" for wood underlayment to receive tile carpeting.
5. Section 09 69 00 "Access Flooring" to receive tile carpeting.

1.2 STANDARDS

A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following:

1. The Carpet and Rug Institute "The Carpet Specifiers' Handbook."
2. The Carpet and Rug Institute "CRI 104; Standard for Installation of Commercial Carpet, edition Sept. 2015" (CRI 104).
3. The Carpet and Rug Institute "Green Label Plus" Standards.

1.3 PRE-INSTALLATION MEETINGS

A. Prior to the installation, and at the Contractor's direction, meet at the project site to review the material selections, substrate preparations, installation procedures, coordination with other trades, special details and conditions, standard of workmanship, and other pertinent topics related to the Work. The meeting shall include the Owner, Architect, the Contractor, the installer, material manufacturer's representatives, and representatives of other trades or subcontractors affected by the installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each product indicated, submit product data, specifications, installation instructions for materials specified herein and other data as may be required to show compliance with the Contract Documents. Include installation recommendations for each type of substrate required.

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. CALgreen Submittals:

1. Product Data for Section 5.504.4.1.1: For sealants, adhesives and caulks, provide documentation including printed statement of VOC content showing compliance with SCAQMD Rule 1168 VOC limits and CCR (California Code of Regulations) Title 17 for aerosols.
2. Product Data for Section 5.504.4.1.2: Provide documentation for aerosol adhesives, and smaller unit sizes of adhesives, sealant, and caulking compounds (in units of product, less packaging, which do not weigh more than one (1) pound and do not consist of more than sixteen (16) fluid ounces) comply with statewide VOC standards and prohibitions on use of certain toxic compounds, of CCR Title 17, commencing with Section 94507.
3. Product Data for Section 5.504.4.4: Submit documentation that all carpet installed within the building interior complies with one of the following:

    a. Carpet and Rug Institute's Green Label Plus Program;
    b. The VOC-emission limits and testing requirements specified in the California Department of Public Health Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, February 2010;
    c. NSF/ANSI 140 at the Gold level or higher;
    d. Scientific Certifications Systems Sustainable Choice;
    e. Compliant with the Collaborative for High Performance Schools California (CA-CHPS) Criteria Interpretation for EQ 7.0 and EQ 7.1 (formerly EQ 2.2) dated July 2012 and listed in the CHPS High Performance Product Database.

4. Product Data for Section 5.504.4.4.1: Submit documentation that all carpet cushion installed within the building interior meet the requirements of the “Carpet and Rug Institute’s Green Label program.”
5. Product Certificates for Section A5.405.1: For products and materials required to comply with requirements for regional materials, provide certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. For the purposes of this requirement, "regional" is interpreted to mean within 500 miles of the project location or within the State of California.
6. Compliance with Section A5.405.4: Provide documentation of use of recycled content materials, equivalent in performance to virgin materials. Provide cost documentation showing value of recycled content using A5.405.4.2.

    a. The RCV shall not be less than 10% of the total project.
    b. The RCV shall not be less than 15% of the total project.

7. Section A5.405.5.1 Cement: Provide documentation that cement complies with one of the following standards:

    a. Portland cement shall meet ASTM C 150.
    b. Blended hydraulic cement shall meet ASTM C 595.

c. Other hydraulic cements shall meet ASTM C 1157.

D. Shop Drawings: Show the following:

1. Existing floor materials to be removed.
2. Existing floor materials to remain.
3. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
4. Carpet tile type, color, and dye lot.
5. Type of subfloor.
6. Type of installation.
7. Pattern of installation, direction, and starting points per floor.
8. Pattern type and location.
9. Type, color, and location of insets and borders.
10. Type, color, and location of edge, transition, and other accessory strips.
11. Pile direction.
12. Transition and other accessory strips.
13. Transition details to other flooring materials.

E. Samples: For each of the products showing full range of color, texture, and pattern variations expected. Prepare samples from same material to be used for the Work. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in Schedules. Submit the following:

1. Carpet Tile: Full-size Samples.
2. Exposed Edge Stripping and Accessory: 12 inch long Samples.

1.5 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:
1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

B. Qualification Data: For Installer.

C. Field Test Reports: Provide signed field test reports for tests indicated below. Indicate results and test locations. Include manufacturer's recommendations.

1. Anhydrous calcium chloride test results.
2. Relative humidity probe test results.
3. Alkalinity test results.

D. Warranty: Submit special warranties specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Submit copies of instructions for care, cleaning, maintenance and repair of carpet tiles.

1. Each carpet manufacturer shall meet with the authorized Building Services personnel in the presence of the Owner, to review the characteristics of the carpet tile, and to recommend appropriate maintenance procedures, prior to occupancy of the finished spaces.
2. Include methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
3. Include precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Materials: Furnish extra materials described below before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Engage a carpet installer, who has completed a minimum of three projects over the last 10 years which were similar in material, design and extent to that indicated for the Project - as determined by the Architect - and which have resulted in construction with a record of successful in service performance.

1. In the case where the Installer is actually a Dealer, it is understood that the terms Installer, Dealer, Carpeting Contractor and Contractor shall be one and the same for purposes of this Contract. Installer shall assume responsibility for all of the work, including acquisition of the materials from the manufacturers herein specified.

B. Mill Inspection: The carpeting may be inspected to determine compliance with the Contract Documents with respect to manufacture, materials, pattern and colors. Inspection may be made at the mill by a representative of the Architect and/or Owner at any time during the process of manufacture.

C. Sample Installations: Before installing carpet, install sample installation, for each type of carpet installation required to demonstrate aesthetic effects and qualities of materials and execution. Install sample installations to comply with the following requirements, using materials indicated for the completed Work:

1. Size and Location: Provide 250 square foot sample installation in location as directed by Architect.
2. Demonstrate the proposed range of aesthetic effects and workmanship.
3. Obtain Architect's approval of sample installations before starting work.
4. Maintain sample installations during construction in an undisturbed condition as a standard for judging the completed Work.
5. Approved sample installations may become part of the completed Work if undamaged at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

B. Deliver carpeting in original mill protective wrapping with mill register numbers and tags attached.

C. Deliver other materials in manufacturer's unopened containers identified with name, brand, type, grade, class, and other qualifying information.

D. Store materials in a dry location, in such a manner as to prevent damage.

1.10 FIELD CONDITIONS

A. General: Comply with CRI 104, Section 7.0 "Site Conditions."

B. Environmental Limitations: Do not deliver or install carpet tile until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during remainder of construction.

C. Do not install carpet tile over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.11 WARRANTY

A. Special Carpet Manufacturer's Warranty: Written warranty, signed by carpet tile manufacturer agreeing to replace carpet tile that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, wear, static buildup in excess of 3.0 kV when tested under the Standard Shuffle Test at 70 deg F and 20 percent RH, edge raveling without seam sealers, tuft bind loss, zippering (wet or dry), shrinkage, curling, doming, snags, runs, and delamination. Warrantees shall be full term, not pro-rated for the specified warranty period.

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

B. Special Carpet Tile Installer's Warranty: Written warranty, signed by carpet tile installer agreeing to fix, repair or replace carpet tile that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than edge raveling, shrinkage, curling, doming, and delamination.

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

PART 2 - PRODUCTS

2.1 CARPET TILE (CP##)

A. Carpet Tile Types: Provide manufacturer's commercial grade carpet tile for 100 percent glue-down installation as indicated in [**Section 09 06 00 "Schedule for Finishes."**] [**Finish Schedule on Drawings.**]

B. Carpet and cushion shall comply with testing and product requirements of CRI's "Green Label Plus" testing program.

C. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Portland cement-based formulation provided by or recommended by carpet tile manufacturer. Do not use gypsum based compounds.

B. Adhesives: Water-resistant, mildew-resistant, and nonstaining, pressure sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for intended carpet tile, and recommended by manufacturer for releasable installation.

1. VOC Limits: Provide adhesives with VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesives shall have a VOC content of [**50**] <**Insert value**> g/L or less.
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Carpet Edging: Provide rubber composition carpet edging in single lengths wherever possible, keeping the number of joints or splices to a minimum. Provide in quantities and locations as job required based upon the recommended good practice of the industry; include in every location where carpet terminates and other flooring continues. Color to match adjacent carpet types.

D. Floor Sealer: Type as recommended and manufactured by the carpet tile manufacturer for the applications indicated.

1. VOC Limits: Provide floor sealer with VOC content not more than 200 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. For wood subfloors, verify the following:

1. Underlayment over subfloor complies with requirements specified in Section 06 10 00 "Rough Carpentry."
2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

D. For metal subfloors, verify the following:

1. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

E. For painted subfloors, verify the following:

1. Perform bond test recommended in writing by adhesive manufacturer.

F. For raised access flooring systems, verify the following:

1. Access floor substrate is compatible with carpet tile and adhesive if any.
2. Underlayment surface is flat, smooth, evenly planed, tightly jointed, and free of irregularities, gaps greater than [1/8 inch] <**Insert dimension**>, protrusions more than 1/32 inch, and substances that may interfere with adhesive bond or show through surface.

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

3.2 PREPARATION

A. General: Comply with CRI 104, Section 8.0 "Substrate Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Coordinate the installation of carpet so as not to delay the occupancy of the site or interfere with the completion of construction.

C. Examine the substrates, adjoining construction and the conditions under which the Work is to be installed. Verify recommended limits for moisture content and alkalinity of concrete substrates with carpet manufacturer.

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

2. Alkalinity Test: Verify alkalinity of concrete substrates by drilling a 3/8 inch diameter hole approximately 1/4 inch deep, remove all residue; fill with distilled water, allow water to stand 3 minutes and test with a calibrated electronic meter or pH paper. Perform testing at a frequency of not less than once every 1,000 square feet.
3. Alternative test procedures for moisture content and alkalinity may be acceptable subject to the carpet manufacturer's review and written acceptance.

D. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Provide one of the following:

   a. Remove coatings, including curing compounds, existing floor covering adhesive residues, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the carpet manufacturer.
   b. In lieu of mechanical substrate preparation methods, the Contractor may utilize floor sealer materials and methods of the types and methods as recommended, in writing, by the carpet tile manufacturer. Apply sealer in number of coats, and at the spread rate, as required by the carpet tile manufacturer.

2. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the carpet tile manufacturer.
3. Use leveling and patching compounds recommended by flooring manufacturer for filling cracks, holes and depressions in the substrate. Surface shall be smooth, level and at proper elevation. Remove ridges, roughness and protrusions from concrete surfaces by grinding.

E. For raised access flooring systems, verify the following:

1. Access floor complies with requirements specified in Section 09 69 00 "Access Flooring."
2. Access floor substrate is compatible with carpet tile and adhesive if any.

F. Broom and vacuum clean substrates to be covered immediately before installing carpet.

G. Carpet installation shall not commence until painting and finishing work are complete and ceiling and overhead work is tested, approved, and completed.

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

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 10.0 "Carpet Tile Installation," carpet tile manufacturer's written installation instructions, and as required to match the accepted sample installations. Apply adhesive in accordance with adhesive manufacturer's directions.

B. Adhere all full size, perimeter tiles, and cut tiles, with a full spread of adhesive. Dry fit cut tiles and apply adhesive to tile back after tile has been cut. Use full uncut tiles down the center of corridors and, where necessary, cut perimeter tiles to butt walls.

1. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
2. Cut openings in carpet for electrical outlets, piping and other penetrations. Maintain close tolerances so that edges of carpet will be covered by plates and escutcheons.
3. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

C. Butt carpet tile tightly together to form seams without gaps or entrapped pile yarns and aligned with adjoining tiles.

D. Edge Strip Installation: Install edge strip at every location where edge of carpet is exposed to traffic, unless otherwise indicated. Unless otherwise directed by Architect install in single lengths and secure in accordance with manufacturer's directions.

E. Traffic over adhesive installations shall be restricted until adhesive has properly cured in accordance with the adhesive manufacturer's recommendations.

3.4 CLEANING AND PROTECTION

A. Cleaning: As the carpeting is installed, remove and dispose of all trimmings, excess pieces of carpeting and laying materials from each area as it is completed. Vacuum carpeting with a commercial vacuum, having a cylindrical brush or beater bar and high suction. Remove adhesives, stains, and soil spots in accordance with the carpet manufacturer's recommendations.

B. Protection: Protect installed carpet tile to comply with CRI 104, Section 11.0 "Post Installation," and against damage as damaged carpeting shall be rejected. Use non-staining cover material for protection. Tape joints of protective covering.

1. Plastic and polyethylene sheet protective coverings shall not be permitted.
2. Remove and replace rejected carpeting with new carpet tile. At the completion of the Work and when directed by the Architect, remove covering, vacuum clean carpeting and remove soiling and stains (if any) to the satisfaction of the Architect.

END OF SECTION 09 68 13

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Galvanized metal.

B. Related Requirements:

1. Section 09 91 23 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
2. Section **09 96 00** "High-Performance Coatings" for special-use coatings.

1.2 DEFINITIONS

A. General: The following terms apply to this Section. Gloss level shall be determined according to ASTM D 523.

1. Gloss Level 3 (Eggshell): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Sustainable Design Submittals: Refer to Division 01 Section "Sustainable Design Requirements."

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat, with texture to simulate actual conditions.

1. Provide stepped Samples, defining each separate coat, including primers. Use representative colors when preparing Samples for review. Resubmit until required gloss, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
3. Submit paint samples on hardboard, 12 inches square, of each color and texture required.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. VOC content.

1.4 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

   a. Vertical and Horizontal Surfaces: Provide samples of at least 20 sq. ft..
   b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

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

1.7 DELIVERY, STORAGE, AND HANDLING

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

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

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in **[snow,]** rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Benjamin Moore & Co. (Benjamin Moore)
2. PPG Paints (PPG)
3. Sherwin-Williams Company (The). (SW)
4. Vista Paint Corp. (Vista).

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles for the paint category indicated.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers.

2.2 PAINT, GENERAL

A. Material Compatibility: Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: Products shall comply with the more stringent requirements of EPA 63 FR 176: 48848and the following:

1. Ozone Transport Commission (OTC), Architectural, Industrial and Maintenance Coatings (AIM), latest adopted requirements.

C. VOC Content: For field applications, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: VOC content of not more than 50 g/L.
2. Nonflat Paints and Coatings: VOC content of not more than 100 g/L.
3. Dry Fog Coatings: VOC content not more than 150 g/L.
4. Primers, Sealers, and Undercoaters: VOC content not more than 100 g/L.
5. Rust-Preventive Coatings: VOC content not more than 100 g/L.
6. Zinc-Rich Industrial Maintenance Primers: VOC content not more than .
7. Pre-Treatment Wash Primers: VOC content not more than 420 g/L.
8. Shellacs, Clear: VOC content not more than 730 g/L.
9. Shellacs, Pigmented: VOC content not more than 550 g/L.

D. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

E. Colors and Gloss: As indicated in Finish Schedule on Drawings. Reference to a particular manufacturer's number or color name is used only as a convenience for the Architect in order to establish the Project color and gloss requirements. These references are not intended to describe the required generic paint systems. For generic paint system requirements, refer to the "Exterior Paint Schedule" at the end of Part 3, as applicable to the respective conditions of use.

1. The selection of paint colors and gloss are indicated by manufacturer and color type; designated as "PT##."

2.3 METAL PRIMERS

A. Primer, Galvanized: As recommended in writing by topcoat manufacturer.

2.4 WATER-BASED PAINTS

A. Light Industrial Coating, Exterior, Water Based (Gloss Level 3):

1. PPG; Pitt-Tech Plus DTM Enamel (90-1110).
2. SW; Pro Industrial High Performance Acrylic Eg-Shel (B66-600 Series).
3. Vista; Protec Alkyd Emulsion Semi-Gloss Enamel (9800).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed to view:

a. Equipment, including panelboards and switch gear.
b. Metal piping.
c. Plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Galvanized-Metal Substrates:

1. Water-Based Light Industrial Coating System:

a. Prime Coat: Primer, galvanized metal, as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated.
b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.

END OF SECTION 09 91 13

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and field painting of exposed interior items and surfaces.

B. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

D. Refer to Division 01 Sections for requirements regarding:

1. LEED credit achievement goals as summarized by the LEED Scorecard attached to Section 01 81 13, 'Sustainable Design Requirements'.

2. Requirements for documentation of LEED credits.

3. Payment application requirements as they relate to LEED documentation requirements.

1.2 DEFINITIONS

A. General: The following terms apply to this Section. Gloss level shall be determined according to ASTM D 523.

1. Gloss Level 1(Flat, or Matte): Not more than 5 units at 60 degrees and 10 units at 85 degrees.
2. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees.
3. Gloss Level 3 (Eggshell): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
4. Gloss Level 4 (Satin or Low Luster): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
5. Gloss Level 5 (Semigloss): 35 to 70 units at 60 degrees.
6. Gloss Level 6 (Gloss): 70 to 85 units at 60-degrees.
7. Gloss Level 7 (High Gloss): More than 85 units at 60 degrees.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Submittals for LEED:

1. Completed "LEED Criteria Worksheet," for each material of the product, assembly, or used in the installation of Work of this section. Refer to Division 01 Section 01 81 13, "Sustainable Design Requirements.
2. Credit IEQ 4.xx for VOC Content: Submit product data for VOC content of all products provided under this section.

    a. Provide documentation on supplier's letterhead of the VOC content of each product provided under this section. Express quantity in g/L or the unit of measurement used in the applicable LEED Reference Guide for that particular type of product.

3. Credit MR 5.xx and Credit ID for Local/Regional Materials: Provide the location of manufacture and/or final assembly for each locally/regionally extracted, processed, and manufactured material incorporated into the work. Locally/regionally extracted or processed is defined as materials having their source as a raw material from within a 500 milesradius of the site. Locally/regionally manufactured is defined as materials having been assembled as a finished product within a 500 miles radius of the project site. Assembly does not include on-site assembly, erection or installation of finished components, as in structural steel, miscellaneous iron or systems furniture. For building materials or products shipped in part by rail or water, the total distance to the project shall be determined by weighted average, whereby the portion of the distance transported by rail is divided by 3, the portion of the distance transported by inland waterways is divided by 2, the portion of the distance transported by sea is divided by 15, and added to the portion of the distance transported by any other means other than by rail, inland waterways, sea, or road, provided the total weighted average distance does not exceed 500 miles (800 kilometers).

    a. Location Documentation: Include distance from the location of manufacture and/or final assembly to the project site for each locally/regionally extracted, processed, and manufactured material incorporated into the work. If only a fraction of the material is extracted and manufactured locally, indicate the percentage by weight. Submit this documentation on the letterhead of the supplier for each locally/regionally extracted, processed, and manufactured material incorporated into the work.

    b. Cost Documentation: Include a printed statement of cost for each regionally extracted, processed, and manufactured material. Submit this documentation on the letterhead of the supplier for each locally/regionally extracted, processed, and manufactured material incorporated into the work.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat, with texture to simulate actual conditions.

1. Provide stepped Samples, defining each separate coat, including primers. Use representative colors when preparing Samples for review. Resubmit until required gloss, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
3. Submit paint samples on hardboard, 12 inches square, of each color and texture required.
4. Submit paint samples on zebra board, 12 inches square, to demonstrate hiding.
5. Submit paint samples on actual substrate to be painted, 12 inches square, of each color and texture required.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. VOC content.

1.4 INFORMATIONAL SUBMITTALS

A. Embodied Carbon Submittals:

1. Completed Environmental Product Declaration Reporting Form for each principal product type in this Section.
2. For products with completed Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific or Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025.
3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Sample Installation: Apply sample installation of each paint system indicated and each color and finish selected to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..

b. Other Items: Architect will designate items or areas required.

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

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Benjamin Moore Family of Products (Benjamin Moore, Coronado, Corotech, Insl-x, LenMar)
2. PPG Paints (PPG)
3. Sherwin-Williams Co. (SW)
4. Vista Paint Corporation (Vista)

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles for the paint category indicated.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers.

2.2 PAINT, GENERAL (PT##)

A. Material Compatibility: Provide materials for use within each paint system that are compatible with one another and with the substrates indicated, under conditions of service and application, as demonstrated by manufacturer based on testing and field experience. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: VOC content of not more than 50 g/L
2. Nonflat Paints and Coatings: VOC content of not more than 100 g/L.
3. Dry Fog Coatings: VOC content not more than 150 g/L.
4. Primers, Sealers, and Undercoaters: VOC content not more than 100 g/L.
5. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC content not more than 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: VOC content not more than 340 g/L.
7. Pre-Treatment Wash Primers: VOC content not more than 420 g/L. Floor Coatings: VOC content not more than 100 g/L.
8. Shellacs, Clear: VOC content not more than 730 g/L.
9. Shellacs, Pigmented: VOC content not more than 550 g/L.

C. VOC Content: Products shall comply with the more stringent requirements of EPA 63 FR 176: 48848 and the following:

1. Ozone Transport Commission (OTC), Architectural, Industrial and Maintenance Coatings (AIM), latest adopted requirements.

D. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Dry-Fog Coatings: 150 g/L.
4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Rust-Preventive Coatings: 100 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Shellacs, Clear: 730 g/L.
9. Shellacs, Pigmented: 550 g/L.

E. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Architectural Paints and coatings shall comply with VOC content as shown in Section 01 81 23 "CALgreen Requirements."

G. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

H. Colors and Gloss: As indicated in [**Section 09 06 00 "Schedule for Finishes."**] [**Finish Schedule on Drawings.**] Reference to a particular manufacturer's number or color name is used only as a convenience for the Architect in order to establish the Project color and gloss requirements. These references are not intended to describe the required generic paint systems. For generic paint system requirements, refer to the "Interior Paint Schedule" at the end of Part 3, as applicable to the respective conditions of use.

1. The selection of paint colors and gloss are indicated by manufacturer and color type; designated as "PT##."
2. Furnish the same lots, batches, etc. within the same contiguous areas of the building (i.e., corridors on the same floors, common rooms which adjoin each other, etc.).

2.3 PREPARATORY COATS

A. Concrete Unit Masonry Block Filler: High-performance latex block filler manufactured by finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.

B. Interior Primers: Interior latex-based primer of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated..

1. Ferrous-Metal Primer: Quick drying, rust-inhibitive metal primer.

2. Zinc-Coated Metal Primer: Galvanized metal primer.

3. Interior Concrete Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.

4. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.

5. Interior Wood Primer: Factory-formulated acrylic-latex-based interior wood primer

6. Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.

2.4 INTERIOR FINISH COATS

A. Interior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for interior application.

1. Benjamin Moore; Ultra Spec WB Interior Flat Finish 443: Applied at a dry film thickness of not less than 1.3 mils.
2. Pittsburgh Paints; PPG SPEEDHIDE zero VOC Latex Flat 6-4110 series Pure Performance Interior Wall Flat Latex 9-100: Applied at a dry film thickness of not less than 1.36 mils.

3. Sherwin-Williams; ProMar 200 Zero VOC Flat B30-2600 Series: Applied at a dry film thickness of not less than 1.5 mils.
4. Glidden Professional; Lifemaster No Voc Interior Flat Paint 9100 Series: Applied at a dry film thickness of not less than 1.3 mils.

B. Interior Flat Latex-Emulsion Size: Factory-formulated flat latex-based interior paint.

1. Benjamin Moore; Ultra Spec WB Interior Flat Finish 443: Applied at a dry film thickness of not less than 1.3 mils.

2. Pittsburgh Paints; PPG SPEEDHIDE zero VOC Latex Flat 6-4110 series Pure Performance Interior Wall Flat Latex 9-100: Applied at a dry film thickness of not less than 1.36 mils.

3. Sherwin-Williams; ProMar 200 Zero VOC Flat B30-2600 Series: Applied at a dry film thickness of not less than 1.5 mils.

4. Glidden Professional; Lifemaster No Voc Interior Flat Paint 9100 Series: Applied at a dry film thickness of not less than 1.3 mils.

C. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.

1. Benjamin Moore; Ultra Spec WB Interior Eggshell 444: Applied at a dry film thickness of not less than 1.4 mils microns).

2. Pittsburgh Paints; PPG SPEEDHIDE zero VOC Latex Eggshell 6-4310 seriesPure Performance Interior Eggshell Wall and Trim 9-300: Applied at a dry film thickness of not less than 1.45 mils.

3. Sherwin-Williams; ProMar 200 Zero VOC Eg-Shel B20-2600 Series: Applied at a dry film thickness of not less than 1.4 mils.

4. Glidden Professional; Lifemaster No Voc Interior Eggshell Paint 9300 Series: Applied at a dry film thickness of not less than 1.4 mils.

D. Interior Semigloss Acrylic Enamel: Factory-formulated semigloss acrylic-latex enamel for interior application.

1. Benjamin Moore; Ultra Spec WB Interior Semi-Gloss 446: Applied at a dry film thickness of not less than 1.4 mils.

2. Pittsburgh Paints; PPG SPEEDHIDE zero Latex Semigloss 6-4510 seriesPure Performance Interior Enamel Wall & Trim Semi-Gloss Latex 9-500: Applied at a dry film thickness of not less than 1.4 mils.

3. Sherwin-Williams; ProMar 200 Zero VOC B31-2600 Series: Applied at a dry film thickness of not less than 1.6 mils.

4. Glidden Professional; Lifemaster No Voc Interior Semi-Gloss Paint 9200 Series: Applied at a dry film thickness of not less than 1.4 mils.

E. Interior Full-Gloss Acrylic Enamel: Factory-formulated full-gloss acrylic-latex interior enamel.

1. Benjamin Moore; Advance Waterbourne Interior Alkyd High Gloss 794: Applied at a dry film thickness of not less than 1.3 mils.

2. Pittsburgh Paints; PPG Speedhide Interior/Exterior 100% Acrylic Gloss Series 6-8534 : Applied at a dry film thickness of not less than 1.2 mils.

3. Sherwin-Williams; Pro Classic Interior Latex Gloss Enamel B21 : Applied at a dry film thickness of not less than 1.5 mils.
4. Glidden Professional; Lifemaster No VOC Interior Gloss Paint 9400 Series: Applied at a dry film thickness of not less than 1.3 mils.

F. Epoxy Enamel Floor Paint:

1. Pittsburgh Paints; PPG Mega-Seal TF, Thin Film Epoxy 99-1001 Series.

2. Sherwin-Williams; ArmorSeal® 650 Epoxy B58Q650 Series.

3. Glidden Professional; Tru-Glaze 4508H Chemical Resistant Epoxy Coating.

G. Primer, Alkali Resistant, Water Based:

1. Benjamin Moore; Super Spec Masonry Int/Ext Acrylic High Build Primer (N068).
2. PPG; Perma-Crete Interior/Exterior Alkali-Resistant Primer (4-603).
3. SW; Loxon Concrete & Masonry Primer Interior/Exterior Latex (A24W8300).

2.5 WATER-BASED PAINTS

A. Latex, Interior, Gloss Level 1 (Flat):

1. Benjamin Moore; Ultra Spec 500 Interior Flat (N536).
2. PPG; SPEEDHIDE zero Interior Zero-VOC Latex Flat (6-4110XI).
3. SW; ProMar 200 Zero VOC Interior Latex Flat (B30-2600 Series).

B. Latex, Interior, Gloss Level 3 (Eggshell).

1. Benjamin Moore; Ultra Spec 500 Interior Eggshell (N538).
2. PPG; SPEEDHIDE zero Interior Zero-VOC Latex Eggshell (6-4310XI).
3. SW; ProMar 200 Zero Interior VOC Latex Eg-Shel (B20-2600 Series).

C. Latex, Interior, Gloss Level 5 (Semigloss):

1. Benjamin Moore; Ultra Spec 500 Interior Semi-Gloss (N539).
2. PPG; SPEEDHIDE zero Interior Zero-VOC Latex Semi-Gloss (6-4510XI).
3. SW; ProMar 200 Zero VOC Latex Semi-Gloss (B31-2600 Series).

D. Latex, Interior, High Performance Architectural, Gloss Level 3 (Eggshell):

1. Benjamin Moore; Corotech PreCatalyzed Waterborne Epoxy Eggshell V342.
2. PPG; Pitt-Glaze WB1 Interior Eggshell Pre-Catalyzed Water-Borne Acrylic Epoxy (16-310).
3. SW; Pro Industrial Pre-Catalyzed Waterbased Epoxy Eg-Shel (K45W1150 Series).

E. Latex, Interior, High Performance Architectural, Gloss Level 5 (Semigloss):

1. Benjamin Moore; Corotech PreCatalyzed Waterborne Epoxy SG (V341).
2. PPG; Pitt-Glaze WB1 Interior Semi-Gloss Pre-Catalyzed Water-Borne Acrylic Epoxy (16-510).
3. SW; Pro Industrial Pre-Catalyzed Waterbased Epoxy Semi-Gloss (K46W1150 Series).

2.6 INDUSTRIAL MAINTENANCE COATINGS

A. Semigloss Dry Fall Coating:

1. Benjamin Moore; Latex Dry Fall Semi-Gloss 397, semi-gloss finish; applied at a dry film thickness of not less than 1.4 mils (36 microns). (formula does not exceed 43 grams/liter VOCs).
2. Subject to requirements, provide the scheduled product, or a similar product, acceptable to the Architect, by one of the following:

    a. Duron.
    b. M. A. Bruder & Sons, Inc. (M. A. B. Paint).
    c. Pittsburgh Paints.
    d. Sherwin-Williams.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with manufacturer's requirements for paint application. Comply with procedures specified in PDCA P4.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

3.2 PREPARATION

A. Remove hardware and hardware accessories, cover plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible, provide surface-applied protection before surface preparation and painting.

B. Before applying paint or other surface treatments, clean substrates of substances that could impair bond of paints. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified. Provide barrier coats over incompatible primers or remove and reprime.

1. Concrete Substrates: Remove release agents, curing compounds, hardeners, sealers, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

    a. Use abrasive blast-cleaning methods if recommended by paint manufacturer
    b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
    c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

2. CMU Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
3. Plaster Substrates: Remove effloresce and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
4. Gypsum Wallboard: Repair all surfaces in gypsum wallboard with wallboard joint finishing compound or spackling compound, filled out flush and sanded smooth. Clean all surfaces and taped joints of dust, dirt and other contaminants and be sure they are thoroughly dry before applying paint.
5. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
6. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
b. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

7. Rubber: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates. Abrade surface to promote adhesion of subsequently applied paints, if necessary.
8. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

D. Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tint each undercoat a lighter shade to facilitate identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. Apply block fillers to CMU at a rate to ensure complete coverage with pores filled.

B. Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in Finish Schedule on Drawings.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
4. Extend coatings in exposed surfaces, as required, to maintain system integrity and provide desired protection.

a. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place.

5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint front and back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces. Paint access panels, electrical panels, air diffusing outlets, supply and exhaust grilles, louvers, exposed conduit, primed hardware items, primed outlet covers, primed wall and ceiling cover plates and other items in painted areas to match the areas in which they occur unless otherwise directed by the Architect.

C. Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

    a. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
    b. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
    c. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

2. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

D. Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

E. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

F. Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

G. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Equipment, including panelboards[**and switch gear**].
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.
h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
i. .

2. Paint the following work where exposed in occupied spaces:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Other items as directed by Architect.
i. <**Insert mechanical items to be painted**>.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

a. Color: Flat (gloss level 1), nonspecular, black.

H. Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 MARKING AND IDENTIFICATION

A. Mark fire-rated and smoke-rated partitions required to have protective openings or penetrations.

1. Locate markings in accessible concealed floor, floor-ceiling, or attic spaces.

2. Provide markings within 15 feet of the end of each wall and at intervals not exceeding 30 feet measured horizontally along the partition.
3. Marking shall include stenciled lettering not less than 3 inches in height with a minimum 3/8 inch stroke.
4. Apply markings in a contrasting color with the suggested wording "FIRE AND/OR SMOKE BARRIER---PROTECT ALL OPENINGS", or other wording as approved by the Authority Having Jurisdiction.

B. Mark sound-rated partitions as follows:

1. Locate markings in accessible concealed floor, floor-ceiling, or attic spaces.
2. Provide markings within 15 feet of the end of each wall and at intervals not exceeding 30 feet measured horizontally along the partition.
3. Marking shall include stenciled lettering not less than 3 inches in height with a minimum 3/8 inch stroke.
4. Apply markings in a contrasting color with the suggested wording "[**STC 45**] [**STC 50**] [**<insert STC rating>**] PARTITION---PROTECT ALL OPENINGS", or other wording as approved by the Owner.

3.5 CLEANING

A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

B. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

C. After completing painting operations in each space or area, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection, if any.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from paint application. Correct damage to work of other trades by cleaning, repairing or replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates:

1. Latex System:

a. Primer: Alkali resistant, water based.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior (gloss as indicated in Finish Schedule).

2. High-Performance Architectural Latex System:

a. Primer: Alkali resistant, water based.
b. Intermediate Coat: Latex, interior, high performance architectural; matching topcoat.
c. Topcoat: Latex, interior, high performance architectural (gloss as indicated in Finish Schedule).

B. CMU Substrates:

1. Latex System:

a. Primer: CMU block filler.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior (gloss as indicated in Finish Schedule).

2. High-Performance Architectural Latex System:

a. Primer: CMU block filler.
b. Intermediate Coat: Latex, interior, high performance architectural; matching topcoat.
c. Topcoat: Latex, interior, high performance architectural (gloss as indicated in Finish Schedule).

C. Plaster Substrates:

1. Latex System:

a. Primer: Alkali resistant, water based.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior (gloss as indicated in Finish Schedule).

2. High-Performance Architectural Latex System:

a. Primer: Alkali resistant, water based.
b. Intermediate Coat: Latex, interior, high performance architectural; matching topcoat.
c. Topcoat: Latex, interior, high performance architectural (gloss as indicated in Finish Schedule).

D. Gypsum Board Substrates:

1. Latex System:

a. Primer: Sealer, latex, interior.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior (gloss as indicated in Finish Schedule).

2. High-Performance Architectural Latex System:

a. Primer: Sealer, latex, interior.
b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
c. Topcoat: Latex, interior, high performance architectural (gloss as indicated in Finish Schedule).

E. Steel Substrates:

1. High-Performance Architectural Latex System:

a. Primer: Acrylic.
b. Intermediate Coat: Latex, interior, high performance architectural; matching topcoat.
c. Topcoat: Latex, interior, high performance architectural (gloss as indicated in Finish Schedule).

2. Semigloss Dry Fall Coating:
a. Primer: Interior semigloss dry fall coating.
b. Intermediate Coat: Interior semigloss dry fall coating.
c. Finish Coat: Interior semigloss dry fall coating.

F. Galvanized Metal Substrates:

1. High-Performance Architectural Latex System:

a. Primer: Acrylic.
b. Intermediate Coat: Latex, interior, high performance architectural; matching topcoat.
c. Topcoat: Latex, interior, high performance architectural (gloss as indicated in Finish Schedule).

G. Wood[and Hardboard] Substrates:

1. High-Performance Architectural Latex System:

a. Primer: Acrylic.
b. Intermediate Coat: Latex, interior, high performance architectural; matching topcoat.
c. Topcoat: Latex, interior, high performance architectural (gloss as indicated in Finish Schedule).

END OF SECTION 09 91 23

SECTION 116800 - PLAY FIELD EQUIPMENT AND STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Freestanding playground equipment and structures.
2. Composite playground equipment and structures.
3. Glass reinforced cast concrete playground equipment.
4. Shade structures.
5. Synthetic Turf Mound.
6. Modular play components.
7. Modular wood tables and benches.
8. Composite garden planters

1.2 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details for playground equipment and structures.

C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Extent of surface systems and use zones for equipment.
2. Critical heights for playground surface, or fall heights for equipment.

D. Samples: For each type of exposed finish.

E. Product certificates.

F. Material Certificates: Wood Preservative Treatment: Include certification by treating plant that states type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.

G. Product test reports.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.

C. Safety Standards: Provide playground equipment complying with or exceeding requirements in the following:

1. ASTM F 1487.
2. CPSC No. 325.

D. Preinstallation Conference: Conduct conference at Project site.

1.4 WARRANTY

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

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

a. Structural failures.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide products as specified on the plans.

2.2 MATERIALS

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

1. Extruded Bars, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
2. Cast Aluminum: ASTM B 179.
3. Flat Sheet: ASTM B 209 (ASTM B 209M).

B. Steel: Comply with the following:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M, hot-dip galvanized.
2. Steel Pipe: ASTM A 53/A 53M or ASTM A 135, standard-weight, hot-dip galvanized.
3. Steel Tubing: ASTM A 500 or ASTM A 513, cold formed, hot-dip galvanized.
4. Steel Sheet: ASTM A 1011/A 1011M, hot-dip galvanized.

5. Perforated Metal: Steel sheet not less than [0.0747-inch (1.9-mm) uncoated thickness; hot-dip galvanized, manufacturer's standard perforation pattern.
6. Expanded Metal: ASTM F 1267, Type II (expanded and flattened), manufacturer's standard carbon-steel sheets, hot-dip galvanized, deburred after expansion.
7. Woven Wire Mesh: Manufacturer's standard, with wire complying with ASTM A 510 (ASTM A 510M).

C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666; Type 304.

D. Chain and Fittings: ASTM A 467/A 467M, Class CS, 4/0 or 5/0, welded-straight-link coil chain; hot-dip galvanized. With commercial-quality, hot-dip galvanized steel connectors and swing or ring hangars.

E. Castings and Hangers: Malleable iron, ASTM A 47/A 47M, Grade 32510, hot-dip galvanized.

F. Post Caps: Cast aluminum or color-impregnated, UV-stabilized, mold-resistant polyethylene or polypropylene; color to match posts.

G. Platform Clamps and Hangers: Cast aluminum or zinc-plated steel, not less than 0.105-inch-(2.7-mm-) nominal thickness.

H. Hardware: Manufacturer's standard; commercial-quality; corrosion-resistant; hot-dip galvanized steel and iron, stainless steel, or aluminum; of a secure and vandal-resistant design.

I. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or plated steel and iron, or stainless steel; permanently capped, and theft resistant.

J. Softwood Plywood: DOC PS 1, exterior.

K. Wood: Species indicated, free of heart center.

1. Douglas fir.
2. Pine.
3. Western red cedar.
4. Redwood.

L. Opaque Plastic: Color impregnated, UV stabilized, and mold resistant.

1. Polyethylene: Fabricated from 96 percent recycled, purified, fractional-melt or approved equal plastic resin; rotationally molded HDPE, LLDPE, or MDPE with not less than 1/4-inch (6-mm) wall thickness.

M. Transparent Plastic: Abrasion-resistant, UV-stabilized monolithic polycarbonate sheet; clear, colorless not less than 3/16 inch (5 mm) thick.

2.3 PLAYGROUND EQUIPMENT FABRICATION

A. Metal Frame: Fabricate main-frame upright support posts from metal pipe or tubing with cross-section profile and dimensions as indicated.

B. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work.

C. Provide castings that are sound and free of warp, cracks, blowholes, or other defects that impair strength or appearance.

D. Composite Frame: Fabricate main-frame upright support posts from metal and plastic with profile and dimensions as indicated.

E. Play Surfaces: Provide manufacturer's standard elevated drainable decks, platforms, landings, walkways, ramps, and similar transitional play surfaces.

F. Elevated Play Surfaces: Guardrails or protective barriers completely surround elevated play surface except for access openings, if play-surface heights above protective surfacing exceed the following for use by age group indicated:

1. Elevated surface greater than 20 inches (510 mm) intended for use by children aged 2 through 5.

G. Stepped Play Surfaces: Provide manufacturer's standard infill between stepped platforms according to referenced standards and where indicated on Drawings.

H. Protective Barriers and Guardrails: Fabricate according to ASTM F 1487.

I. Handrails: Welded metal pipe or tubing, OD between 0.95 and 1.55 inches (24.1 and 39.4 mm). Provide handrails at height for use by age group indicated below:

1. Ages: Between 2 and 5 years.
2. Height of Top Surface: 29 inches (737 mm) intended for use by children aged 2 through 5.
3. Close exposed ends of handrails with returns with clearance of 1/4 inch (6 mm) or less.

J. Roofs and Canopies: Manufacturer's standard plastic and steel

K. Signs: Manufacturer's standard sign panels, fabricated from opaque plastic with graphics molded in, attached to upright support posts.

1. Text: Per Landscape Architect.
2. Colors: Selected from manufacturer's full range of colors.

2.4 FREESTANDING PLAYGROUND EQUIPMENT AND STRUCTURES

A. Provide free standing playground equipment and structures for age groups 2-5 years old and 6-23 months as specified on the plans and product manufacturers below:

1. Products:
   a. Landscape Structures Inc.

2.5 COMPOSITE PLAYGROUND EQUIPMENT AND STRUCTURES

A. Composite Structure: Provide composite playground equipment and structures for age groups 2-5 years old and 6-23 months as specified on the plans and product manufacturers below:

1. Products:
   a. Landscape Structures Inc.;

2.6 GLASS REINFORCED CAST CONCRETE PLAYGROUND EQUIPMENT

A. Provide glass reinforced cast concrete playground equipment for age groups 2-5 years old and 6-23 months as specified on the plans and product manufacturers below:

1. Products:
   a. Landscape Structures Inc.;

2.7 SHADE STRUCTURES

A. Provide shade structures as specified on the plans and product manufacturers below:

1. Products:
   a. Landscape Structures Inc.;

2.8 SYNTHETIC TURF MOUND

A. Provide synthetic turf mounds for age groups 2-5 years old and 6-23 months as specified on the plans and product manufacturers below:

1. Products:
   a. Landscape Structures Inc.;
   b. Forever Lawn Inc.;

2.9 MODULAR PLAY COMPONENTS

A. Provide modular play components for age groups 2-5 years old and 6-23 months as specified on the plans and product manufacturers below:

1. Products:
   a. Landscape Structures Inc.;
   b. Nature of Early Play;

2.10 MODULAR WOOD TABLES AND BENCHES

A. Provide modular wood tables, benches and interactive play components for age groups 2-5 years old and 6-23 months as specified on the plans and product manufacturers below:

1. Products:
   a. Community Playthings.;

2.11 COMPOSITE GARDEN PLANTERS

A. Provide composite fixed garden planters with open bottoms as specified on the plans and product manufacturers below:

1. Available Products:
   a. Gardeners Supply Company;

2.12 CAST-IN-PLACE CONCRETE

A. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-In-Place Concrete".

2.13 FINISHES, GENERAL

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

2.14 ALUMINUM FINISHES

A. Baked-Enamel Finish: Prepare, treat, and coat metal to comply with paint manufacturer's written instructions.

B. PVC Finish: Manufacturer's standard, UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish.

C. Color: As selected by Architect from manufacturer's full range.

2.15 IRON AND STEEL FINISHES

A. Galvanizing: Hot-dip galvanize to comply with ASTM A 123/A 123M.

1. Hot-dip galvanize steel and iron hardware indicated to be galvanized to comply with ASTM A 153/A 153M.
2. Galvanized Steel Sheet: Commercial steel sheet, hot-dip galvanized, complying with ASTM A 653/A 653M for not less than G60 (Z180) coating designation; mill phosphatized.

B. Powder-Coat Finish: Prepare, treat, and coat ferrous metal to comply with resin manufacturer's written instructions.

C. Baked-Enamel Finish: Apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat.

D. PVC Finish: Manufacturer's standard, UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with minimum dry film thickness of 100 mils (2.5 mm).

E. Color: As selected by Architect from manufacturer's full range.

2.16 STAINLESS-STEEL FINISHES

A. Bright, Cold-Rolled, Unpolished Finish: No. 2B finish on exposed faces.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions, unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.

1. Maximum Equipment Height: Coordinate installed heights of equipment and components with finished elevations of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.

C. Post Set on Subgrade: Level bearing surfaces with drainage fill to required elevation.

D. Post Set with Concrete Footing: Comply with ACI 301 for measuring, batching, mixing, transporting, forming, and placing concrete.

1. Set equipment posts [**in**] [**on**] concrete footing.
2. Embedded Items: Use setting drawings and manufacturer's written instructions to ensure correct installation of anchorages for equipment.

END OF SECTION 116800