Maine Medical Center

Visitor Garage Expansion

22 Bramhall Street, Portland, ME

PROJECT MANUAL VOLUME 1

Construction Documents

Specification Sections 02 - 10

September 29, 2017

Project # 152182.000

CONDITIONALLY APPROVED

SAFEbuilt

City of Portland

MUNICIPALITY

D.A. Mattox, P.E.

Plan Reviewer

8414519 / 15433 04/05/2018

ICC/Maine PE License DATE

PERKINS+WILL

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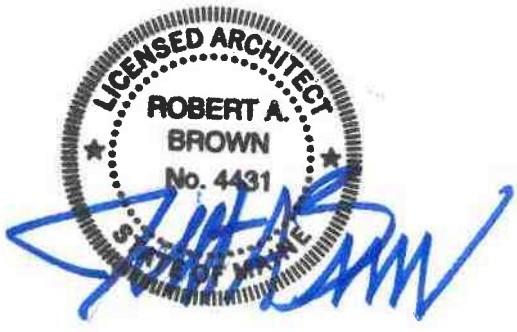

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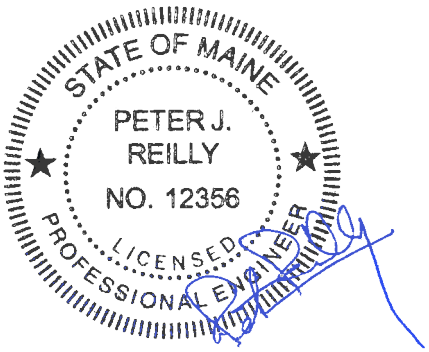

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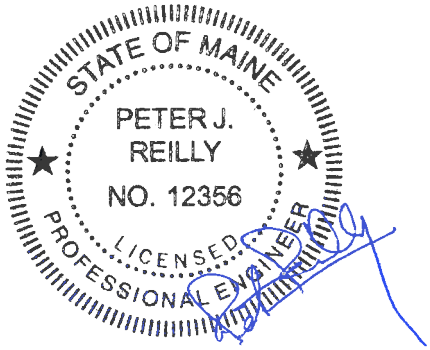

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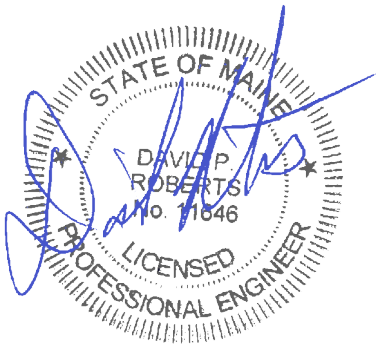

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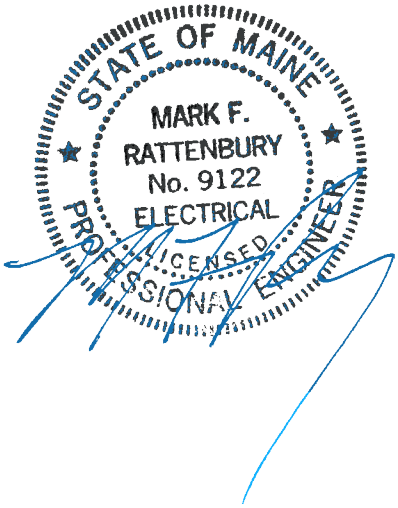

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SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
   2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. **Alternate No. 1, Photovoltaic (PV) equipment:**
1. Base Bid: As indicated on the Drawings, without Photovoltaic (PV) equipment.
2. Alternate: Add photovoltaic equipment:
    a. PV panels.
        1) Support structure for PV panel arrays,
            a) Calculations to show loads imposed upon base structure with engineering stamp for design team review.
    b. Inverters,
    c. Tie into electrical panels,
3. References:
    a. Drawings:
        1) A10-40 ROOF PLAN
        2) A20-10, A20-20, A20-30, A20-40 ELEVATIONS
        3) A21-01 SECTIONS
        4) E00-01 ELECTRICAL GENERAL NOTES, SYMBOLS AND ABBREVIATIONS
        5) E10-20 ELECTRICAL LIGHTING & POWER PLAN – SECOND FLOOR & ROOF
        6) E11-10 ELECTRICAL PARTIAL FLOOR PLANS.
    b. Specifications:
        1) Section 05 50 00 "Metal Fabrications" for framing and supports.
        2) Section 09 96 00 "High Performance Coatings" for finishing framing and supports.

B. Alternate No. 2, Fall protection for existing floors of garage:
1. Base Bid: Base condition includes removing existing fall protection from ground floor and reinstalling it on levels 2 and 3, As indicated on the Drawings, without fall protection for existing floors of garage.
2. Alternate: Add Fall protection for existing floors of garage:
3. References:
    a. Drawings:
        1) A20-10, A20-20, A20-30, A20-40 ELEVATIONS
    b. Specifications:
        1) Section 10 82 13 "Exterior Grilles And Screens"

C. Alternate No. 3, Charging Stations:

1. Base Bid: Provide charging stations at new floors as indicated.
2. Alternate: Add charging stations to existing floors (in same locations as at new floors, Levels Basement (P7) and below):
3. References:
   a. Drawings:
      1) E10-10, E10-20.
   b. Specifications:
      1) Division 26 Electrical Sections, as appropriate.

END OF SECTION

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SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:
1. Section 01 10 00 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 01 73 00 "Execution" for cutting and patching procedures.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:
1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 01 32 33 "Photographic Documentation." Submit before Work begins.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. Hazardous materials will be removed by Owner before start of the Work.
   2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

1.9 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:
   1. Roofing system – verify if under warranty.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.10 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
   1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

F. Survey of Existing Conditions: Record existing conditions by use of measured drawings preconstruction photographs or video and templates.
   1. Comply with requirements specified in Section 01 32 33 "Photographic Documentation."
   2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
   3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Arrange to shut off utilities with utility companies.

2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
    1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
    2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
    3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
    4. Cover and protect furniture, furnishings, and equipment that have not been removed.
    5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
    1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
   5. Maintain fire watch during and for at least 2 hours after flame-cutting operations.
   6. Maintain adequate ventilation when using cutting torches.
   7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
   9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   10. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 74 19 "Construction Waste Management and Disposal."

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area on-site designated by Owner.
   5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:
   1. Clean and repair items to functional condition adequate for intended reuse.
   2. Pack or crate items after cleaning and repairing. Identify contents of containers.
   3. Protect items from damage during transport and storage.
   4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 01 74 19 "Construction Waste Management and Disposal."
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
   4. Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.8 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.9 SELECTIVE DEMOLITION SCHEDULE

A. Items indicated on the Drawings.

END OF SECTION

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SECTION 033000

CAST-IN-PLACE CONCRETE

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.

B. Refer to other Divisions of these Specifications to determine the type and extent of work therein affecting the work of this trade, whether or not such work is specifically mentioned in this Section.

1.2 SUMMARY

A. Except for that specifically excluded below, furnish, and combine materials for all the work indicated on the Drawings or herein specified to be of plain or reinforced concrete, its installation with forms and reinforcement, its curing, and its finishing. Shop drawings, tools, ways, apparatus, and equipment necessary for concrete production, installation, and finish are included.

B. The work under this Section includes but is not limited to the following:
   1. Slabs on metal deck.
   2. Metal pan stair fill, housekeeping pads, and curbs for equipment.
   3. Furnishing and installing joint fillers, sealants, dams, and similar items required in conjunction with the concrete work.
   4. Installing items furnished by other trades and required to be built into the concrete work.
   5. Grouting column base plates.
   6. Installing embedded steel anchorages provided by others for the attachment of structural steel and masonry
   7. All other items of concrete and related work shown on the Drawings, specified herein, or needed to make the work of this Section complete.

C. The following are excluded from the work specified in this Section:
   1. Inserts and pipe sleeves for mechanical trades to be furnished, coordinated, and installed by mechanical contractors.

D. Specification Sections that directly relate to the work of this Section include, but are not limited to, the following:
   1. Section 01 33 00 – Submittal Procedures
   2. Section 04 20 00 – Unit Masonry
   3. Section 05 12 00 – Structural Steel Framing
   4. Section 05 31 00 – Metal Decking
   5. Section 07 13 53 – Elastomeric Sheet Waterproofing
   6. Section 07 92 00 – Joint Sealants

E. Notify all other trades responsible for installing inserts, sleeves, etc., when ready for such installation and for final checking immediately before concrete is placed. Cooperate with such trades to obtain proper installation. Leave openings in walls for pipe, ducts, etc., for mechanical and electrical work as shown on Drawings or required by layout of systems.

1.3 DEFINITIONS

A. Supplementary Cementitious Materials (SCM): One or more of the following: blended hydraulic cement, fly ash and other pozzolans, slag cement, and silica fume; subject to compliance with requirements.

B. Special Inspector: Personnel performing Owner-provided testing and inspections as specified and as required by 2015 International Building Code (IBC).

1.4 REFERENCED STANDARDS

A. Follow the guidelines contained in the latest editions of the following codes, specifications, and standards, including references contained in each document, except where more stringent requirements are shown or specified.

B. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO T260 – Methods of Sampling and Testing for Total Chloride Ion in Concrete and Concrete Raw Materials

C. American Concrete Institute (ACI):
1. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials
2. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
3. ACI 211.2 – Standard Practice for Selecting Proportions for Structural Lightweight Concrete
4. ACI 214 – Recommendation for Evaluation of Compression Test Results of Field Concrete
5. ACI 301 – Standard Specification for Structural Concrete
6. ACI 304 – Recommended Practice for Measuring, Mixing and Placing Concrete
7. ACI 305 – Recommended Practice for Hot Weather Concreting
8. ACI 306 – Recommended Practice for Cold Weather Concreting
9. ACI 306.1 - Standard Specification for Cold Weather Concreting
10. ACI 308 – Guide to Curing Concrete
11. ACI 309 – Recommended Practice for Consolidation of Concrete
12. ACI 311 – Recommended Practice for Concrete Inspection
13. ACI 315 – Manual of Standard Practice for Detailing Reinforced Concrete Structures
14. ACI 318 – Building Code Requirements for Reinforced Concrete
15. ACI 613 – Recommended Practice for Selecting Proportions for Concrete

D. ASTM International (ASTM):
1. ASTM C31 – Standard Method of Making and Curing Concrete Test Specimens in the Field
2. ASTM C33 – Standard Specification for Concrete Aggregates

3. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
4. ASTM C94 – Standard Specification for Ready-Mixed Concrete
5. ASTM C143 – Standard Method of Test for Slump of Portland Cement Concrete
6. ASTM C150 – Standard Specification for Portland Cement
7. ASTM C173 – Standard Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method
8. ASTM C192 – Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Laboratory
9. ASTM C231 – Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method
10. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete
11. ASTM C309 – Standard Specification for Liquid Membrane – Forming Compounds for Curing Concrete
12. ASTM C494 – Standard Specifications for Chemical Admixtures of Concrete
13. ASTM E329 – Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction

E. National Ready Mixed Concrete Association (NRMCA):
1. NRMCA Check List for Certification of Ready Mixed Concrete Production Facilities

F. Concrete Reinforcing Steel Institute (CRSI):
1. Manual of Standard Practice

1.5 SUBMITTALS

A. General:
1. All submissions shall be in accordance with the submission schedule, which shall be developed and agreed between the Architect and Construction Manager at the commencement of the project.
2. Submittals shall be made in compliance with the Conditions of the Contract and Division 01 Specification Section 01 33 00 – Submittal Procedures.
3. Review of submittals is of a general nature only, and the responsibility for conformance to the intent of Contract Documents shall remain with the Contractor. Review does not imply or state that the Contractor has correctly interpreted the construction documents.
4. The Contractor shall make all submittals in electronic PDF file format and shall include the Structural Engineer of Record's (SER) submittal review stamp in each PDF file. The SER will only return PDF files to the Contractor.
5. Simultaneously with reinforcing steel shop drawings, the Contractor shall submit coordinated slab and wall penetration drawings showing locations and sizes of sleeved penetrations required by plumbing, electrical, mechanical, and fire protection trades.

B. Submit the following action submittals for review and approval:
1. Concrete Mix Design for Each Type of Concrete: The Contractor shall warrant by the submission of the design mixes that such mixes are totally representative of the concrete that he intends to supply to meet the requirements of the Contract Documents. Submit new design mixes for

review and approval when any change in materials is required or needed. Include the following information for each concrete mix design:

a. Method used to determine the proposed mix design (per ACI 301, Article 3.9).
b. Compressive Strength at Seven and Twenty-Eight Days. 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.
c. Gradation of Fine and Coarse Aggregates: Testing data confirming proposed coarse aggregate meets ASTM C33 class designation. Include ASTM test results for aggregates subject to freeze-thaw environment.
d. Certification of non-reactivity of aggregates: Include supplier's certificate demonstrating that aggregate is nonreactive in the presence of alkalis in accordance with ASTM C1260 or ASTM C1293.
e. Proportions of all ingredients, including all admixtures to be added at the time of batching. Addition of water during delivery, at the Project site, or during placement is prohibited unless specifically approved by the SER. Refer to Section 3.9B.
f. Water-cement ratio.
g. Placement method.
h. Slump tested in accordance with ASTM C143.
i. Air content of freshly mixed concrete by the pressure method, ASTM C231, or the volumetric method, ASTM C173.
j. Unit weight of concrete ASTM C138.
k. Mill test reports of fly ash chemical and physical analysis and certification of compliance with ASTM C618, Class C or F, if used.
l. Manufacturer's Data Sheets of each concrete admixture, including brand name, manufacturer, dosage sequence, and dosage rate range.

2. Shop drawings for reinforcement detailing, fabricating, bending, and placing concrete reinforcement. Show supplementary shear reinforcement at columns (stud rails) on reinforcement plans where required. Comply with ACI 315 – Manual of Standard Practice for Detailing Reinforced Concrete Structures, showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.
3. Plans showing the proposed locations of construction and control joints in columns and slabs.
4. Formwork shop drawings for architecturally exposed concrete elements.
5. Product data for proprietary materials and items, including reinforcement and forming accessories, form release agent, form facing products, admixtures, patching compounds, bonding agents, curing compounds, joint protectors, slide bearings, malleable iron wedge inserts, dovetail slots, base plate grout, and others if requested by the Architect.
6. Proposed methods for finishing concrete flatwork.
7. Proposed methods for curing cast-in-place concrete.

C. Submit the following informational submittals for record:
1. Health and Safety Data Sheets for each concrete admixture.
2. Proposed Schedule of Concrete Placement. Contractor shall keep a permanent log of the dates and times of concrete placement and where on

the project the concrete was cast. This log shall be made available to the Architect for inspection, upon request.

3. Qualifications of Concrete Foreman showing 5 yrs experience with this type of concrete installation.
4. Hot and cold weather concreting procedures
5. Tickets for each batch of concrete delivered to the jobsite containing the following information:
   a. The design compressive strength of the concrete being delivered.
   b. The volume of concrete in the delivery truck.
   c. The time the concrete was batched (i.e., the time that water was discharged into the delivery truck to mix with the cement and aggregates).
   d. List of admixtures and dosage rates.
   e. Slump of concrete as placed at the point of deposit in the work.
   f. Permissible volume of water added to the delivery truck after initial batching.
   g. Specific location where the concrete is being placed.
   h. If, upon reaching the jobsite, the concrete cannot be placed within the time limits stated below, or if the type of concrete delivered is incorrect, the Owner's Testing Laboratory will reject the load.

1.6 QUALITY ASSURANCE

A. Foreman's Qualifications: Concrete work shall be done under the supervision of an experienced concrete foreman having at least 5 yrs of foreman experience with cast-in-place concrete, similar to that used on this project.

B. The Contractor shall perform all work in strict accordance with all applicable laws and regulations of the building code and with all other authorities having jurisdiction. All such requirements shall take precedence over the requirements of the Specifications, except in cases where the requirements of the Specifications are more exacting or stringent.

C. Concrete Mix Design: The Contractor shall employ an independent testing laboratory, acceptable to the Owner, to perform material evaluation tests and to design concrete mixes or, when acceptable to the SER, provide copies of recently made material tests and mix designs. If, at any time during construction, the concrete resulting from the approved mix design deviates from Specification requirements, the Contractor shall have his laboratory modify the design, subject to approval, until the specified concrete is obtained.

D. Testing of materials and inspections of installed work shall be completed throughout the duration of the project, as directed by the SER. The Contractor shall provide free and safe access to material stockpiles and facilities for inspectors. Retesting of rejected materials and/or re-inspection of deficient work shall be done at the Contractor's expense.

E. The Contractor is responsible for correction of concrete work that does not conform to the specified requirements, including strength, mix proportions, air void system, tolerances, and finishes. Correct deficient concrete as directed by the SER.

F. All finishing crewmembers shall be ACI Certified Concrete Flatwork Technicians and Finishers. The supervisor shall be an ACI Certified Flatwork Technician and shall

have input to the crew's placement and finishing procedures regarding the application of ACI Standards for quality flatwork. The ACI Standards that shall be observed are contained in the ACI – Concrete Craftsman Series.

G. The Architect will reject cast-in-place concrete that exhibits the following defects:
   1. Bulging: Concrete surfaces that bulge due to insufficiently secured formwork, undersized ties, or flat bar clamps.
   2. Wavy Concrete: Concrete surfaces that exhibit waves along plywood joints due to moisture migration into unsealed cuts of plywood sheets causing swellings.
   3. Spalling: Concrete spalling due to shale, alkali reactivity, rusting steel too close to the surface, carbonation, improper removal of formwork, expansion of cast-in steel during the welding process, or other reasons.
   4. Cracking and Crazing: Concrete cracking and crazing due to lack of control joints or high water/cement ratio (above 0.50).
   5. Air Holes: Air holes resulting from improper vibration and excessive heights of individual layers of pours between vibration. Air holes due to spreading of concrete with vibrators rather than moving buckets or hoses.
   6. Honeycombing: Concrete honeycombing, including loss of fines from leaking formwork or other causes.
   7. Discoloration: Concrete discoloration caused by any reason, including inconsistent concrete mix, different sources of cement and aggregates, temperature variation between individual pour and curing phases, improper and inconsistent use of vibrators, variation of timespan of concrete in formwork, form oils, and migration of plasticizer into concrete from exposed sealant beads on formwork and around
      cast-in items such as electrical outlet boxes.
   8. Visible Pour Joints: Visible pour joints in concrete resulting from: leaking formwork due to lack of gaskets and insufficient overlap with old concrete preventing proper tightening of formwork; placement of concrete layers in excessive heights; and spreading concrete with vibrator.
   9. Debris in Concrete: Concrete that includes debris, whether caused by insufficient cleaning of formwork or lack of cleanout and access doors at base of formwork.

H. The Contractor shall schedule a Concrete Preconstruction Meeting at least thirty days prior to placement of any concrete. Attendance at the meeting shall include the Construction Manager, the Ready Mix Supplier, the Concrete Subcontractor, the Concrete Pumping Subcontractor, Special Inspector, the Field Testing Laboratory, the Architect, and the SER. The agenda of the meeting shall be prepared by the Contractor and shall include, but not be limited to, the following:
   1. Review of concrete mix designs.
   2. Concrete placing sequence and schedule.
   3. Formwork, shoring, re-shoring, and stripping procedures.
   4. Placing, jointing, and finishing procedures.
   5. Cold-weather and hot-weather concreting procedures.
   6. Construction of control and isolation joints, joint-filler strips, and semi-rigid joint fillers.
   7. Anchor rod, anchorage device, and embedment installation and tolerances.
   8. Steel reinforcement installation.

9. Installing sleeves furnished by other trades and penetration coordination drawings.
10. Curing and protection procedures.
11. Slab flatness and levelness criteria and measurement.
12. Review of independent special inspection and testing and inspecting agency procedures for field quality assurance.

I. The Contractor shall obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

J. Concrete Testing Service: The Contractor shall engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

K. The Owner shall employ a Special Inspector to oversee and administer**,** and an independent Testing Agency(s) to perform, a Program of Structural Tests and Inspections for compliance with Chapter 17 of the 2015 International Building Code (IBC). The SER has prepared a statement of structural tests and inspections, specifying the structural tests and inspections to be performed throughout the construction of this project. Submission to and approval of this statement by the local building official must be complete prior to beginning construction.
1. The Special Inspector will organize and direct the test and inspection program. All inspection and test reports shall be submitted to the Contractor, Construction Manager (CM), the Owner's Representative, and the SER. The Contractor shall be responsible for understanding the test and inspection program and notifying the Testing Agency and the Special Inspector when work is ready for tests and/or inspections. The Contractor will provide access to the Testing Agency, Special Inspector, and the SER. Performing the inspections and tests of the Program of Structural Tests and Inspection will not relieve the Contractor of responsibility for supervision, testing, and inspection for quality control of the work.
2. The Testing Agency and Special Inspector shall submit written reports to the Contractor, Construction Manager (CM), the Owner's Representative, and the SER within two business days of all inspections that describe any construction that does not conform to the Contract Documents. The Special Inspector shall re-inspect all nonconforming construction after the Contractor has corrected the nonconforming construction and prepare a written report of the re-inspection within two business days of the re-inspection.
3. The Owner's Representative will provide testing and inspection reports to the local building official when requested by the local building official. Upon completion of the construction, the independent Special Inspector will make a final report on the satisfactory completion of the Program for Structural Tests and Inspection to the building official and to the Owner's Representative.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending, damage, and exposure to road salt spray.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Provide SF-3.0 in accordance with ACI 301-10. Use form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Provide SF-1.0 in accordance with ACI 301-10. Use plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 in. x 3/4 in., minimum.

E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

F. Form-Release Agent: Commercially formulated form-release agent with a maximum of 100 g/l volatile organic compounds (VOC) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 in. to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 in. in diameter in concrete surface.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, deformed, as required.

C. Deformed-Steel Welded Wire Reinforcement: ASTM A1064, flat sheet.

D. Steel Bar Mats: ASTM A184/A184M, fabricated from ASTM A615/A615M, Grade 60, deformed bars, assembled with clips.

E. Plain-Steel Tie Wire: ASTM A1064, as drawn.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's Manual of Standard Practice, of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless steel bar supports.

C. Mechanical Bar Couplers:
   1. Where required, provide mechanical couplers capable of developing 125% of the reinforcing bar yield strength.

D. Dowel Bar Anchors:
   1. Dowel Bar Splicer by Dayton Superior
   2. Lenton Form Saver Dowel Bar Substitute by Erico

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C150, Type I/II, gray
   2. Fly Ash: ASTM C 618, Class F. Maximum mercury content 2 ppb (0.002 mg/l). Fly ash may not be sourced from a coal plant co-fired with hazardous waste, medical waste, or tire-derived fuel, or from a municipal solid waste incinerator.
   3. Slag Cement: ASTM C989, Grade 100 or 120. Slag may not be sourced from a plant co-fired with hazardous waste, medical waste, or tire-derived fuel.
   4. Silica Fume: ASTM C1240, amorphous silica.

B. Normal-Weight Aggregates: ASTM C33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 5 yrs satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Nominal Maximum Coarse-Aggregate Size: See Table 1 below. Free of materials with deleterious reactivity to alkali in cement.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C330. See Table 1 below. Free of materials with deleterious reactivity to alkali in cement.

D. Water: ASTM C94/C94M and potable.

2.5 ADMIXTURES

A. General Admixture Requirements:

1. The concrete supplier and Contractor shall use manufacturer's product identified in this Section or submit alternate manufacturer product for approval by the SER.
2. All admixtures used in the concrete shall be produced by a single manufacturer.
3. Concrete supplier and Contractor shall certify compatibility of all ingredients in each mix design. Use admixtures in strict accordance with manufacturer's recommendations.
4. Concrete supplier and Contractor shall account for admixture volume in the concrete mix proportions in accordance with admixture manufacturer's recommendations.
5. Do not use calcium chloride or admixtures containing more than 0.1% chloride ions.

B. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures. Subject to compliance with requirements; provide one of following, or approved equivalent:
1. Air-Tite, Cormix Construction Chemicals.
2. Air-Mix or Perma-Air, Euclid Chemical Co.
3. Darex AEA or Daravair, W.R. Grace & Co.
4. MasterAir VR10 or MasterAir AE 200, BASF.
5. Sealtight AEA, W.R. Meadows, Inc.
6. Sika AER, Sika Corp.

C. Water-Reducing Admixture: ASTM C494, Type A. Subject to compliance with requirements; provide one of following, or approved equivalent:
1. Chemtard, ChemMasters Corp.
2. PSI N, Cormix Construction Chemicals.
3. Eucon WR-75, Euclid Chemical Co.
4. WRDA, W.R. Grace & Co.
5. Master Pozzolith or MasterPolyheed, BASF.
6. Metco W.R., Metalcrete Industries.
7. Prokrete-N, Prokrete Industries.
8. Plastocrete 161, Sika Corp.

D. Water-Reducing and Retarding Admixture: ASTM C494, Type D. Subject to compliance with requirements; provide one of following, or approved equivalent:
1. PSI-R Plus, Cormix Construction Chemicals.
2. Eucon Retarder 75, Euclid Chemical Co.
3. Daratard-17, W.R. Grace & Co.
4. MasterPozzolith 100 XR, BASF.
5. Protard, Prokrete Industries.
6. Plastiment, Sika Corporation.

E. Water-Reducing Accelerating Admixture: ASTM C494, Type E. Subject to compliance with requirements; provide one of following, or approved equivalent:
1. Q-Set, Conspec Marketing & Manufacturing Co.
2. Lubricon NCA, Cormix Construction Chemicals.
3. Accelguard 80, Euclid Chemical Co.
4. Daraset, W.R. Grace & Co.
5. MasterSet FP 20, BASF.
6. Accel-Set, Metalcrete Industries.

F. High Range Water-Reducing Admixture: ASTM C494, Type F or Type G. Subject to compliance with requirements; provide one of following, or approved equivalent:
   1. Super P, Anti-Hydro Co., Inc.
   2. Cormix 200, Cormix Construction Chemicals.
   3. Eucon 37, Euclid Chemical Co.
   4. WRDA 19 or Daracem, W.R. Grace & Co.
   5. Rheobuild 1000 or MasterPolyheed, BASF.
   6. Superslump, Metalcrete Industries.
   7. PSPL, Prokrete Industries.
   8. Sikament 300, Sika Corp.

G. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C494/C494M, Type C. Subject to compliance with requirements; provide one of following, or approved equivalent:
   1. Boral Material Technologies, Inc.; Boral BCN.
   2. Euclid Chemical Company (The); Eucon CIA.
   3. Grace Construction Products, W. R. Grace & Co.; DCI.
   4. BASF; MasterLife CI 30.
   5. Sika Corporation; Sika CNI.

H. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating anodic inhibitor or mixed cathodic and anodic inhibitor capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete. Subject to compliance with requirements; provide one of following, or approved equivalent:
   1. Axim Concrete Technologies; Catexol 1000CI.
   2. Boral Material Technologies, Inc.; Boral BCN2.
   3. Cortec Corporation; MCI 2000.
   4. Grace Construction Products, W. R. Grace & Co.; DCI-S.
   5. BASF; MasterLife CI 222.
   6. Sika Corporation; FerroGard-901.

I. Shrinkage Reducing Admixture: Mix capable of maintaining long-term concrete shrinkage strain to 450 microstrain or less.
   1. Eclipse by Grace Construction Products
   2. Approved equal

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Subject to compliance with requirements; provide one of following, or approved equivalent:
   1. Axim Concrete Technologies: Cimfilm.
   2. Burke by Edoco: BurkeFilm.
   3. ChemMasters: Spray-Film.
   4. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company: Aquafilm.
   5. Dayton Superior Corporation: Sure Film or Clear Dissipating Cure EF.
   6. Euclid Chemical Company (The): Eucobar.
   7. Kaufman Products, Inc.: Vapor Aid.

8. Lambert Corporation: Lambco Skin.
9. L&M Construction Chemicals, Inc.: E-Con.
10. MBT Protection and Repair, Div. of ChemRex: Confilm.
11. Meadows, W. R., Inc.: Sealtight Evapre.
12. Metalcrete Industries: Waterhold.
13. Nox-Crete Products Group, Kinsman Corporation: Monofilm.
14. Sika Corporation, Inc.: SikaFilm.
15. Symons Corporation, a Dayton Superior Company: Finishing Aid.
16. Unitex: Pro-Film.
17. US Mix Products Company: US Spec Monofilm ER.
18. Vexcon Chemicals, Inc.: Certi-Vex EnvioAssist.

B. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz/sq yd when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

D. Curing Paper: ASTM C171, opaque appearance, for all concrete flatwork.

E. Water: Potable.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating. Curing compounds may not be used on any concrete flatwork. Subject to compliance with requirements; provide one of following, or approved equivalent:
1. Anti-Hydro International, Inc.: AH Curing Compound #2 DR WB.
2. Burke by Edoco: Aqua Resin Cure.
3. ChemMasters: Safe-Cure Clear.
4. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company: W.B. Resin Cure.
5. Dayton Superior Corporation: Day Chem Rez Cure (J-11-W).
6. Euclid Chemical Company (The): Kurez DR VOX.
7. Kaufman Products, Inc.: Thinfilm 420.
8. Lambert Corporation: Aqua Kure-Clear.
9. L&M Construction Chemicals, Inc.: L&M Cure R.
10. Meadows, W. R., Inc.: 1100 Clear.
11. Nox-Crete Products Group, Kinsman Corporation: Resin Cure E.
12. Symons Corporation, a Dayton Superior Company: Resi-Chem Clear Cure.
13. Tamms Industries, Inc.: Horncure WB 30.
14. Unitex: Hydro Cure 309.
15. US Mix Products Company: US Spec Maxcure Resin Clear.
16. Vexcon Chemicals, Inc.: Certi-Vex Enviocure 100.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

C. Adhesive Rebar Anchors/Dowels:
1. Epcon Ceramic 6 Epoxy Rebar Anchor by ITW Ramset/Red Head.

2. Hilti HIT-HY 200 System.
3. Approved equal providing same or higher allowable tensile and shear loads at the indicated embedment, spacing, and edge distance.

D. Non-metallic, Non-shrink Grout: ASTM C109 compressive strength of 8,000 psi minimum at twenty-eight days, prepared at flowable consistency. Provide "Five Star" by U.S. Grout Corp., or approved equal.

2.8 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 in. and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 in., or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4,100 psi at twenty-eight days when tested according to ASTM C109/C109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 in. and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded washed gravel, 1/8 in. to 1/4 in., or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5,000 psi at twenty-eight days when tested according to ASTM C109/C109M.

2.9 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures. Do not use the same testing agency for field quality control testing.

B. Limit water-soluble chloride-ion content in hardened concrete to 0.06% by weight of cement unless SER approves a higher limit and corrosion inhibitors are added to the mixture to offset the additional chloride. Water-soluble chloride ion content by weight of cement and of concrete shall be tested in accordance with FHWA RD-77 or AASHTO T260-84.

C. Design mixes to use maximum replacement of cement with fly ash, slag cement, or other supplementary cementitious materials (SCM) while meeting performance criteria. For limits on SCMs, see Table 1. The quantities in Table 1 assume either

fly ash **OR** slag cement. If a mix of SCMs is used (e.g., fly ash plus slag cement), the total percent replacement cannot exceed 50% of the weight of the total cementitious materials and cannot exceed the maximum individual SCM limits provided in Table 1.

D. Air Content: Measure at point of deposit into the work. If concrete will be pumped, design mix for air loss due to pumping.

E. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a water-cementitious-materials ratio below 0.45.
   4. Use corrosion-inhibiting admixture in concrete mixtures for exterior site walls exposed to deicing salts in accordance with ACI 318 Exposure Class C2.

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

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.
   1. When air temperature is between 80°F and 90°F, reduce mixing and delivery time from 1-1/2 hrs to 75 min.; when air temperature is above 90°F, reduce mixing and delivery time to 60 min.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, floor drains, and other related materials with placement of forms and reinforcing steel.

3.2 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

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

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

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete except shelves supporting metal panel cladding.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.3 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's Manual of Standard Practice for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, road salts, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. New Concrete Common with Existing Concrete: Where new concrete will be placed against existing concrete, roughen surface of existing concrete to 1/4 in. minimum amplitude.

C. Construction Joints: Install so that the strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

D. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water or admixtures to concrete during delivery, at Project site, or during placement, unless specifically approved by SER.

C. Deposit concrete for concrete elements (i.e. slabs, beams, columns, walls, etc.) continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of such a depth as to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 in. into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete

embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. For unshored slabs on composite metal deck, place slabs to constant elevation. Metal floor deck is designed for unshored two-span conditions. Single-span conditions may require shoring.
   3. Maintain reinforcement in position on chairs during concrete placement.
   4. Screed slab surfaces with a straightedge and strike off to correct elevations.
   5. Slope surfaces uniformly to drains where required.
   6. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average of the high and low air temperatures is expected to fall below 40°F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
   4. Do not apply deicing salts to concrete flatwork for at least 1 yr after placement.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:
   1. Maintain concrete temperature below 90°F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is the Contractor's option.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities. Provide SF-1.0 in accordance with ACI 301-10.
   1. Apply to concrete surfaces not exposed to public view and surfaces not designated to receive waterproofing membranes.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair

and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities. Provide SF-3.0 in accordance with ACI 301-10.

1. Apply to concrete surfaces exposed to public view and to surfaces designated to receive membrane waterproofing.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hrs.

D. Related Unformed Surfaces: 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. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude in one direction of 1/4 in.

1. Apply scratch finish to surfaces indicated and to receive mortar setting beds for bonded cementitious floor finishes and epoxy terrazzo finishes.

C. Float Finish: Consolidate surface with power-driven floats, or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture. Grid smooth any surface defects that would telegraph through applied floor finishes.

1. Apply float finish to surfaces indicated to receive trowel finish.
2. Apply float finish to surfaces indicated receive finished flooring, including resilient flooring, thin-set tile, quarry tile set over a cleavage membrane.
3. Apply float finish to surfaces indicated to be shot blasted, including moisture mitigation systems.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and

appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view.
2. Do not apply trowel finish to slabs indicated to be shot blasted prior to receiving finished flooring.

E. Broom Finish: Apply a broom finish to exterior concrete slabs-on-grade, pads, platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

F. Finish surfaces to the following tolerances, according to ASTM E1155, for a randomly trafficked floor surface:

1. Suspended, Formed Concrete Slabs: Specified overall values of flatness, F_F 30; and of levelness, F_L 20; with minimum local values of flatness, F_F 24; and of levelness, F_L 15. Make F_F and F_L measurements prior to removing shoring.
2. Suspended, Concrete Slabs on Composite Floor Deck: Specified overall values of flatness, F_F 30 with minimum local values of flatness, F_F 24.
3. Slabs-on-Grade: Specified overall values of flatness, F_F 35; and of levelness, F_L 25; with minimum local values of flatness, F_F 24; and of levelness, F_L 17.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.10 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions that will cause predicted moisture loss of 0.2 lb/sq ft x hr or more before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period,

moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1 by one or a combination of the following methods:
   1. Moisture Curing: Use moisture curing for concrete flatwork. Keep surfaces continuously moist for not fewer than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water-saturated and kept continuously wet. Cover concrete surfaces and edges with 12 in. lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Use moisture-retaining-cover curing for concrete flatwork. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 in., and sealed by waterproof tape or adhesive. Cure for not fewer than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   3. Curing Compound: Do not use curing compounds on any concrete flatwork. Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within 3 hrs after initial application. Maintain continuity of coating and repair damage during curing period.
      a. Do not use curing compound for concrete surfaces to receive floor coverings unless using a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3.11 JOINT FILLING

A. Coordinate with Division 07 Section: Joint Sealants.

B. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

C. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

D. Install semirigid joint filler full depth in saw-cut joints and at least 2 in. deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to
two-and-a-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins, and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 in. in any dimension in solid concrete, but not less than 1 in. in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, pop-outs, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 in. wide, or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least fourteen days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 in. to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   5. Repair defective areas, except random cracks and single holes 1 in. or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4 in. clearance all around. Dampen concrete surfaces in contact with

patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

6. Repair random cracks and single holes 1 in. or less in diameter with patching mortar. Groove top of cracks, cut out holes to sound concrete, and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hrs.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 QUALITY CONTROL AND QUALITY ASSURANCE

A. Special Inspection and Testing Agency: Owner will engage a qualified, independent Special Inspector and Testing Agency to perform field tests and inspections and prepare test reports.

B. Inspections and tests performed by the independent Special Inspector and Testing Agency do not relieve the Contractor of the responsibility of control over the quality of the Work.

C. Refer to the Program of Structural Tests and Inspection, including but not limited to inspection of the following:
   1. Concrete formwork.
   2. Steel reinforcement placement.
   3. Embedded items.
   4. Verification of use of required design mixture.
   5. Concrete placement, including conveying and depositing.
   6. Curing procedures and maintenance of curing temperature.
   7. Measure floor and slab flatness and levelness according to ASTM E1155 within 48 hrs of finishing.

END OF SECTION

SECTION 03 41 00

STRUCTURAL PRECAST CONCRETE

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.

B. Refer to other Divisions of these Specifications to determine the type and extent of work therein affecting the work of this trade, whether or not such work is specifically mentioned in this Section.

C. If conflicts between documents arise, then the more stringent requirements shall control, unless notified in writing by the SER/Architect.

1.2 DEFINITIONS

A. Terminology used in this Section
1. Owner: Maine Medical Center
2. Architect: Architect of Record (Perkins+Will)
3. SER: Structural Engineer of Record (Simpson Gumpertz & Heger Inc.)
4. Construction Manager: Turner Construction
5. Owner's Representative: Colliers International
6. Precast Fabricator: PCI Certified firm responsible for the fabrication of the precast portions of the Project.
7. Precast Designer: Registered engineer responsible for the precast concrete portions of the Project, hired by or employed by the Precast Fabricator.
8. Precast Erector: PCI Certified firm responsible for the erection and installation of the precast portions of the Project.

1.3 REFERENCE STANDARDS

A. American Concrete Institute (ACI):
1. ACI 301-16 – Standard Specifications for Structural Concrete.
2. ACI 318-14 – Building Code Requirements for Reinforced Concrete.

B. American Society of Civil Engineers (ASCE):
1. ASCE 7-10 – Minimum Design Loads for Buildings and Other Structures.

C. Prestressed Concrete Institute (PCI):
1. PCI MNL-116 – Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.
2. PCI MNL-117 – Manual for Quality Control for Plants and Product of Architectural Precast Concrete Products.
3. PCI MNL-120-10 – Design Handbook Precast Prestressed Concrete, 7th edition.

D. Concrete Reinforcing Steel Institute (CRSI):
1. CRSI MSP-2 – Manual of Standard Practice.

E. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO – LRFD Bridge Design Specifications, 7th Edition, with 2015 and 2016 Interim Revisions.
   2. AASHTO M251 – Plain and Laminated Elastomeric Bridge Bearings

F. ASTM International (ASTM): Newest published revisions of standards referenced in this Section.

G. American Welding Society (AWS):
   1. AWS D1.1 – Structural Welding Code – Steel.
   2. AWS D1.4 – Structural Welding Code – Reinforcing Steel.
   3. AWS D1.6 – Structural Welding Code – Stainless Steel.
   4. AWS WZC (D19.0) – Welding Zinc-Coated Steel.

1.4 SUMMARY

A. In accordance with all Contract Documents, furnish and install all materials associated with the precast concrete work, which may include, but is not limited to, inserts, clamps, nuts, bolts, bearing pads, base plates, storage and handling protection, product design, and engineering and other work including connections shown on Drawings required to complete Work.

B. Structural precast concrete components include the following:
   1. Precast-concrete double-tee units.
   2. Precast-concrete inverted-tee and L-beams.
   3. Precast-concrete spandrel beams.
   4. Precast-concrete columns.
   5. Structural precast wall units.
   6. Connection and supporting hardware.
   7. Grout and shims between precast-concrete members.

C. Related Work:
   1. Section 03 30 00 – Cast-in-Place Concrete
   2. Section 05 12 00 – Structural Steel Framing
   3. Section 07 18 00 – Traffic Coatings
   4. Section 07 19 00 – Water Repellents
   5. Section 07 92 00 – Joint Sealants

D. Work Furnished but Not Installed:
   1. Anchor bolts and other embedments with placement drawings for embedment in existing precast concrete to provide for attachment of new precast pieces.
   2. As-Built Anchor Bolt and Embedments Location Survey: Provide with sufficient time for the SER to review and for corrective action. Notify the Construction Manager and SER of any discrepancies before piece erection. Submit proposed needed corrections to the SER for review with survey.
   3. Alignment Survey: Furnish to the Construction Manager after all precast members in final position, but before architectural precast panels are erected. Refer to Para. 3.1.G of this Section for erection tolerances.

E. The following work may be performed by others:
   1. Setting of all embedments and anchor bolts into existing precast concrete.
   2. Installation of all joint sealant systems.
   3. Provision for site access and storage for precast delivery and installation.

1.5 SUBMITTALS

A. Make submittals in accordance with requirements of Division 1 and as specified herein.

B. Product Data: For each type of product.

C. Shop Drawings:
1. Prior to submitting shop drawings, survey the type and location of all anchorages in existing precast pieces that will need to interface with new precast pieces. Submit survey to the SER for review and approval.
2. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement.
3. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.
4. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
5. Indicate separate face and backup mixture locations and thicknesses.
6. Indicate type, size, and length of welded connections by AWS standard symbols.
7. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
8. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
9. Include and locate openings larger than 10 inches. Where additional structural support is required, include header design.
10. Indicate location of each precast structural concrete unit by same identification mark placed on panel.
11. Indicate relationship of precast structural concrete units to adjacent materials.
12. Indicate locations, dimensions, and details of thin-brick units, including corner units and special shapes, and joint treatment.
13. Indicate shim sizes and grouting sequence.
14. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

D. Samples:
1. For each type of finish indicated on exposed surfaces of precast structural concrete units with architectural finish, in sets of three, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 in.
2. Samples for each thin-brick unit required, showing full range of color and texture expected. Include Samples showing color and texture of joint treatment.
3. Clearly label samples on the back or with tags to indicate:
   a. Name of Project
   b. Construction Manager
   c. Precast Fabricator or Source
   d. Sample Number
   e. Sample Type
   f. Intended location in the building

E. Design Calculations:

1. Where design is required by Precast Fabricator, submit design calculations for all pieces with shop drawings to SER before production.
2. Submit calculations for each type, shape, loading condition, and span of precast unit called for on the Drawings and all related supports and connections. Design of precast units shall be under the direct supervision of a Professional Engineer registered in the State of Maine; calculations shall bear Precast Designer's seal and signature.

F. Erection Plan:
1. Submit to the SER for review, prior to construction, erection procedure, erection sequence, calculations and details for guying, staying, and shoring of all precast components to assure structural stability during the construction stage before completed permanent structural connections are in place.
2. Provide, in the erection plan, for removal, replacement, or relocation of guying, bracing, and shoring of the structure during the construction state to accommodate the Work of other trades.
3. Provide, in the erection plan, for temporary shoring of existing precast concrete components necessary to install new components as part of the new construction.
4. If, during construction, modifications are necessary to accommodate other trades, revise and resubmit the erection plan to the SER for review and approval.
5. The erection plan shall be prepared and certified by a registered Professional Engineer in the State of Maine.
6. Review of the erection plan by the SER does not relieve the Precast Erector of responsibility for the stability and safety of the structure during the construction stage.

G. Concrete Mix Design: Submit concrete mix design to the SER in accordance with PCI requirements before production of precast-concrete pieces.

H. Concrete Test Reports: Semimonthly, and/or upon request during production of precast-concrete pieces, submit for the SER's review reports of testing of concrete used in precast-concrete pieces.

I. Qualification Data: For Precast Fabricator, Precast Designer, Precast Erector, and Precaster's Testing Agency.

J. Copies of AWS welder's certificates for all welders to be employed on the Project.

K. Material Certificates: For the following:
1. Cementitious materials.
2. Reinforcing materials and prestressing tendons.
3. Admixtures.
4. Bearing pads.
5. Structural-steel shapes and hollow structural sections.
6. Thin-brick units and accessories.

L. Resubmittals: The SER/Architect will review each of the Construction Manager's shop drawings and/or submittals the initial time and, should resubmittal be required, one additional time to verify that reasons for resubmittal have been addressed and corrections made. Resubmittal changes/revisions shall be circled. SER/Architect will review only circled items and will not be responsible for non-circled changes/revisions/corrections and additions. Should additional resubmittals be required, Construction Manager shall reimburse Owner for all costs incurred

including the costs of SER/Architect's services to review such additional submittals. Owner will in-turn reimburse SER/Architect.

M. SER/Architect reserves the right to reject any Request for Information (RFI) that the SER/Architect, at their sole discretion, deems frivolous or already answered by the Contract Documents. The RFI process shall not be used for requested substitutions.

1.6 QUALITY ASSURANCE

A. Precast Fabricator Qualifications:
   1. All precast-concrete work shall be done by a firm that has a demonstrated capability, subject to the Architect's, Owner's, and SER's approval, to produce type of precast work specified. Precast-concrete supplier shall have sufficient production capacity to design, produce, transport, and deliver required pieces without causing delay in the Project.
   2. Participates in PCI's Plant Certification program and is designated a PCI-certified plant as follows:
      a. Group C – Category C1 and C3
      b. Group CA – Category C1A and C3A
   3. Precast Fabricator shall have on staff, or retain, a licensed Professional Engineer, registered in the State of Maine and the state in which precast concrete is to be fabricated, to design the precast concrete in accordance with the requirements of ACI 318-14 and the 2015 International Building Code (IBC).
      a. The Precast Designer shall provide and maintain at all times during the performance of this Work a $2,000,000 Professional Liability Insurance Policy for errors and omissions.
      b. Comply with design recommendations of PCI MNL-120.

B. Precast Erector Qualifications: An experienced, minimum of 5 years, precast concrete erector qualified and designated by PCI's Certificate of Compliance, to erect Category S2 – Complex Structural Systems.

C. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.

D. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code – Steel."
   2. AWS D1.4, "Structural Welding Code – Reinforcing Steel."

E. Source Quality Control: Quality control of precast-concrete products shall be the responsibility of the Precast Fabricator. For manufacturing procedures, testing requirements, and quality-control recommendations for types of units required, comply with PCI MNL-116. The SER and Owner's Testing Agency or their representative shall have access to the manufacturing plant at all times during the manufacture of precast-concrete products. The Precast Fabricator shall cooperate with the SER and Owner's Testing Agency by providing casting schedules when requested.

F. The Owner shall employ a Special Inspector to oversee and administer, and an independent testing agency(s) to perform, a Program of Special Tests and Inspections for compliance with Chapter 17 of IBC 2015. The SER has prepared a statement of structural tests and inspections specifying the tests and inspections to

be performed throughout the construction of this project. Submission to and approval of this statement by the local building official must be complete prior to beginning construction.

1. The Special Inspector will organize and direct the test and inspection program. All inspection and test reports shall be submitted to the Construction Manager, the Owner's Representative, and the SER within 48 hrs of each inspection visit. The Precast Fabricator shall be responsible for understanding the test and inspection program and notifying the Testing Agency and the Special Inspector when work is ready for tests and/or inspections. The Precast Fabricator will provide access to the Testing Agency, Special Inspector, and the SER. Inspections and tests of the Structural Tests and Inspection Program will not relieve the Precast Fabricator of responsibility for supervision, testing, and inspection for quality control of the work.
2. The Testing Agency and Special Inspector shall submit written reports to the Contractor, Construction Manager (CM), the Owner's Representative, and the SER within two business days of all inspections that describe any construction that does not conform to the Contract Documents. The Special Inspector shall re-inspect all nonconforming construction after the Contractor has corrected the nonconforming construction and prepare a written report of the re-inspection within two business days of the re-inspection.
3. The Owner's Representative will provide testing and inspection reports to the local building official when so requested. Upon completion of the construction, the Special Inspector will make a final report on the satisfactory completion of the Program for Structural Tests and Inspection to the building official and to the Owner's Representative.

G. Concrete Testing:
   1. Precast Fabricator shall perform and pay for compression tests for all precast-concrete work. Testing is subject to observation by the Owner's Testing Agency. Use certified test equipment. Unless otherwise specified, conform to the following:
      a. PCI MNL-116 for all members unless noted otherwise.
   2. Precast Structural Concrete Testing: Sample, test, and report concrete in accordance with PCI MNL-116, with the following exceptions:
      a. Placement is defined as 50 cu yd placed for each day of production.
      b. Make six cylinders per placement: 3 at beginning (labeled "A") and 3 at end of placement (labeled "B").
      c. Cure only one "A" and one "B" cylinder made for each placement per PCI MNL-116. Test these cylinders to verify concrete compressive strength at transfer of prestress.
      d. Other cylinders may be cured per Section 03 30 00 and tested at twenty-eight days to verify design compressive strength of concrete.
      e. Discard remaining cylinders after fifty-six days with approval in writing by the SER.

H. Precast Fabricator shall provide casting schedule to the SER with first shop-drawing submittal. Precast Fabricator shall notify the SER 48 hrs in advance of casting of each piece type (tees, L-beams, spandrel beams, inverted-tee beams, columns, wall panels, or other pieces) so that the SER or his designee may review reinforcement fabrication at Precast Fabricator's plant before casting. The SER may request notification for specific piece marks.

I. Pre-installation Conference: Conduct conference at Project Site to comply with requirements in Division 1 Section 01 31 10 "Project Meetings."

J. Sample Panels: After sample approval and before fabricating precast structural concrete units with architectural finish or thin-brick facing, produce a minimum of two sample panels approximately 16 sq ft in area for review by Architect and Owner. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.
   1. Locate panels where indicated or, if not indicated, as directed by Architect.
   2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
   3. After approval of repair technique, maintain one sample panel at Precast Fabricator's plant and one at Project Site in an undisturbed condition as a standard for judging the completed Work.
   4. Demolish and remove sample panels when directed.

K. Mockups: After sample panel approval but before production of precast structural concrete units with architectural finish or thin-brick facing, construct full-sized mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at the time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store pieces at the Project site to prevent cracking, distortion, warping, staining, or other physical damage and so that markings are visible.

B. Manufacturing, delivery, and erection schedules shall be coordinated by the Contractor.

C. Support units during shipment on non-staining shock-absorbing material in same position as during storage.

D. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping, or other physical damage.

E. Lift and support units only at designated points indicated on Shop Drawings.

F. Allow adequate time for curing of precast pieces before erection as required herein.

1.8 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design precast structural concrete units.

B. The Contract Documents show precast member sizes assumed and used as a basis for Architectural Drawings and Details and for verifying the capacity of existing building elements affected by the new construction. Alternate member sizes and connection details will be accepted only if structurally required and if they have a negligible effect on the existing building and the architecture.

C. System described herein is intended to perform in ACI 362.1R-12 Zone III environment without long-term corrosion or other distress. If maintained per manufacturer's recommendations, system is expected to function satisfactorily for 40 years.

D. Minimum Durability Design Requirements:

1. Provide stainless steel plates for all field connections in horizontal deck surfaces. All other exposed plates shall be hot-dipped galvanized or stainless steel. Touch up galvanizing with zinc-rich paint after field welds are made. Unexposed plates shall be primed.
2. Tee-to-tee flange connectors shall be stainless steel. Diaphragm connector plates shall be stainless steel with stainless steel welded rebar.
3. Provide extra reinforcing around all openings, including door openings per General Notes.
4. Corrosion Inhibitor: At all driving surfaces (inverted-tee beams and double-tee beams), the concrete mix shall contain a minimum dosage rate of 2 gal of corrosion inhibitor per cubic yard. Manufacturer of calcium nitrate materials shall have a minimum of 5 yrs' experience in the production of corrosion inhibitors for concrete.
    a. Test and Performance Data: The corrosion inhibitor shall have been tested in accordance with the following test procedures:
        1. FHWA/RD-83/102.
        2. ASTM G61.
        3. ASTM G109.
    b. Subject to the compliance with requirements, provide one of the following:
        1. "Eucon CIA," The Euclid Chemical Company.
        2. "DCI" or "DCI-S," W.R. Grace.
        3. Approved equal.
5. Clear Penetrating Sealer: Material suitable for application on horizontal surfaces containing not less than 40% silane in mineral spirits or alcohol-based carrier. Provide certification of 90% chloride screen effectiveness when tested in accordance with the procedure of NCHRP Report No. 244, "South Climate Exposure," at manufacturer's recommended rate of application.
    a. Subject to compliance with requirements, provide one of the following:
        1. Protectosil Aqua-Trete 40 – Evonik.
        2. Enviroseal 40 – BASF Building System.
        3. Iso-Flex 618-50 WB – Lymtal International Inc.
        4. Approved equal.
6. Water-Borne Penetrating Sealer: Material suitable for application on horizontal surfaces where odor or VOC is an issue.
    a. Ashford Formula – distributed by Righter Group, Wilmington, Massachusetts.
    b. CT Densifier –Tnemec/Chemprobe Co.

E. Structural Performance: Precast structural concrete units and connections shall withstand design loads indicated on the Contract Documents within limits and under conditions indicated.
1. Unless noted otherwise, all design shall be in accordance with governing codes, standards, and references listed in General Notes and in this Specification Section.
2. Minimum concrete strengths shall be per General Notes and as noted herein.
3. Pieces shall be designed considering all vertical loads (which may include nonbearing partitions, stairs, bollards, fill concrete, and other loadings shown on Architectural Drawings), lateral loads due to wind, seismic, temperature differentials, shrinkage, shortening, and effects due to prestressing.
4. Ultimate design capacity of inserts, coil rods, and coil bolts in tension shall not be greater than 90% of yield capacity of weakest piece.

5. Minimum concrete cover of reinforcement, prestressing strands, etc., shall be based on ACI 318-14.

F. Precast System Design Criteria: Comply with ACI 318 and with design recommendations in PCI MNL-120.
   1. Shear Walls:
      a. Precast shear walls shall be as shown on the Drawings.
      b. Design shall include number and location of vertical reinforcement, vertical reinforcement splices, shear reinforcement, and concrete haunch design, including dowels and anchorage at existing building interface. Splice locations shall be as shown on the Drawings.
      c. Connections between precast pieces and precast and cast-in-place elements shall be as required to uniformly transfer lateral loads to the shear walls without overstress of any connected elements.
   2. Connections:
      a. Where shown on Contract Drawings, the number of connections shown is a minimum and is intended to establish the standard of performance. The SER reserves right to accept or reject alternate details. Design as necessary to transfer gravity loads, lateral loads, torsion forces, and forces due to volume change effects.
      b. Positive connections shall be made by welds, bolts, or cast-in-place reinforcement.
      c. Bearing pads shall be provided by Precast Fabricator as shown on Contract Drawings. Refer to Materials Section for additional information.
      d. Beam to column bearing pads at columns shall not extend under beam ledge unless ledge is designed for bearing or recessed to prevent bearing.
      e. Provide column and wall base plates and shims such that base plate grouting is needed before erection of pieces supported by column or wall.
      f. Perform diaphragm analysis and design diaphragm connection details for lateral design loads.
   3. Double Tees:
      a. Design shall include type, number, and location of strands, flange reinforcement, shear reinforcement, end bearing plate, and confinement reinforcement.
      b. Design flanges to support design dead load and either uniform (design) live load or concentrated wheel live load as shown on General Notes.
      c. Maximum tensile stress at bottom of tee for dead load plus live load shall be per ACI 318-14, Section 24.5. Class C members are only permitted under dead-plus-live-plus snow loading.
      d. Stresses in member may not exceed Class U stress limits per ACI 318-14 throughout the stripping, handling, shipping, and installation processes.
      e. As determined by Project conditions, design as "restrained" or "unrestrained" piece for purposes of fire-rating requirements. Fire-rated double tees are to be used where shown on the Contract Drawings. Use ASTM E119 Appendix X3 and Table X3.1 to determine restraint conditions. Minimum cover of reinforcement, prestressing strands, etc., and other fire-rating design criteria shall be based on this premise.
      f. Flange-to-flange connections shall be as shown on Contract Drawings.

g. Surfaces to receive cast-in-place concrete topping shall be roughened to allow proper bond per ACI 318-14.
h. Flange reinforcement shall be epoxy coated.

4. Beams: Inverted Tee and Spandrel
   a. Design shall include type, number, and location of longitudinal reinforcements, shear and torsion reinforcement, end bearing plates and confinement reinforcement, connection requirements, and ledge reinforcement.
   b. Ledge reinforcement shall be designed per PCI MNL-120. Continuity shall be maintained between both faces of reinforcement at ends of pieces.
   c. If piece is to be prestressed, maximum tensile stress at bottom of beam for dead load plus live load shall be per ACI 318-14, Section 24.5. Class C members are only permitted under dead-plus-live-plus snow loading.
   d. Stresses in member may not exceed Class U stress limits per ACI 318-14 throughout the stripping, handling, shipping, and installation processes.
   e. Skew ends of beams as required for sloping bays.
5. Columns:
   a. Design shall include number and location of vertical reinforcement, vertical reinforcement splices, shear reinforcement, concrete haunch (corbel) design, including bearing plates and anchor bolts at column splices.
   b. Splice locations shall be placed as shown on the Contract Documents or at alternate locations as approved by the SER/Architect.
   c. Live loads may be reduced as permitted by IBC 2015, up to a maximum of 20% for members supporting two or more floors.

1.9 PRODUCT WARRANTY

A. Provide warranty similar to sample below:
   1. Precast Fabricator warrants that all materials furnished have been manufactured in accordance with the specifications for this project. Precast Fabricator further warrants that if erection of said material is to be performed by those subject to this control and direction, work will be completed in accordance with the same specifications.
   2. In no event shall Precast Fabricator be held responsible for any damages, liability or costs of any kind or nature occasioned by or arising out of the actions or omissions of others, or for work, including design, done by others, or for material manufactured, supplied or installed by others; or for inadequate construction of foundations, bearing walls, or other units to which materials furnished by the Precast Fabricator are attached or affixed.
   3. Period of this warranty shall be 5 years beginning at date of beneficial occupancy. Should any defect (other than hairline cracks: defined as not more than 0.003 in. wide) be discovered after acceptance and occupancy of Project, which can be directly attributed to defect in product material or workmanship not evident at time of initial occupancy, then Precast Fabricator shall, upon written notice, correct defects or replace products without expense to Owner, SER/Architect or Construction Manager. In sole judgment of SER/Architect, any defects resulting from issues outlined in paragraph above, or resulting from normal wear and tear, product color changes or

improper maintenance procedures are not considered responsibility of Precast Fabricator.

1.10 REPAIR WARRANTY

A. Furnish Owner with written total responsibility guarantee that repairs will be free of defects, water penetration and deterioration related to repair design, workmanship or material deficiency.

B. Warranty period shall be 5 years commencing with date of acceptance of repair.

C. Perform any repair under warranty at no cost to Owner.

D. Before construction, Precast Fabricator shall provide SER/Architect with sample of final warranty.

PART 2 – PRODUCTS

2.1 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
   1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

B. Form Liners: Units of face design, texture, arrangement, and configuration to match those used for precast concrete design reference sample. Furnish with manufacturer's recommended form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

C. Surface Retarder: Chemical set retarder, capable of temporarily delaying setting of newly placed concrete mixture to depth of reveal specified.

2.2 REINFORCING MATERIALS

A. Double tee flange reinforcement shall be epoxy coated.

B. Reinforcing Bars: ASTM A615, Grade 60, deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A706, deformed.

D. Galvanized Reinforcing Bars: ASTM A615, Grade 60 or ASTM A706, deformed, with ASTM A 767 Class II zinc coating and chromate treatment. Galvanized after fabrication and bending.

E. Epoxy-Coated Reinforcing Bars: ASTM A615, Grade 60 or ASTM A706, deformed bars, ASTM A775 or ASTM 934 epoxy coated.

F. Steel Bar Mats: ASTM A184, fabricated from ASTM A615, Grade 60, deformed bars, assembled with clips.

G. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064, flat sheet.

H. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884, Class A coated, deformed, flat sheet.

I. Stainless Steel Reinforcement: ASTM A955, Grade 60, deformed.

J. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL-116.
   1. For uncoated reinforcement, use all-plastic bar supports.
   2. For epoxy-coated reinforcement, use all-plastic bar supports.
   3. For zinc-coated reinforcement, use all-plastic bar supports.

K. Reinforcing Bar Splices:
   1. NMB Splice Sleeve System
   2. Approved Equivalent

2.3 PRESTRESSING TENDONS

A. Prestressing Strand: ASTM A416, Grade 270, uncoated, seven-wire, low-relaxation strand.

2.4 CONCRETE MATERIALS

A. Ready Mixed Concrete: Obtain concrete from plant with current certification from:
   1. Concrete Materials Engineering Council.
   2. Maine Department of Transportation.
   3. National Ready Mixed Concrete.
   4. Prestressed Concrete Institute.

B. Portland Cement: ASTM C150, Type I or Type III. Use one cement type and source throughout project. No change in brand without prior written acceptance from SER/Architect.

C. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
   1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
      a. 60% - 1/2 in. gray granite.
      b. 40% - 1/2 in. pink feldspar.
   2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate to match approved finish sample.
      a. Crushed gray granite.
   3. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL-116.
   4. Fly Ash:
      a. Permitted in all parts of structure.
      b. ASTM C618, Class C or F
      c. Testing: ASTM C311.
      d. Percentage of fly ash in mix design shall be by weight, not by volume. Water/cement ratio will be calculated as water/cementitious (total cement and fly ash) ratio.

e. Prohibited: Fly ash in same mix with Type IP blended cement.
f. Submit all fly ash concrete mix designs per ACI 301.
g. If strength or air content varies from value specified by more than specified tolerances, SER/Architect or designated representative shall reject that concrete.

5. Ground Granulated Blast-Furnace Slag (GGBF):
   a. ASTM C989, Grade 100 or higher.
   b. Percentage of GGBF slag in mix design shall be by weight, not by volume. Water-cement ratio shall be calculated as water-cementitious (total Portland cement + GGBF slag) ratio.
   c. Prohibited: GGBF slag in same mix with cementitious materials other than Portland cement.
   d. Submit all GGBF slag concrete mix designs per ACI 301.
   e. If strength or air content varies from value specified by more than specified tolerances, SER/Architect or designated representative shall reject that concrete.
6. Storage of Materials:
   a. Cementitious Material: Store and handle aggregate in a manner that will avoid segregation and prevent contamination with other material or other sizes of aggregates. Store aggregates to drain freely. Do not use aggregates that contain frozen lumps.
   b. Water and Ice: Protect mixing water and ice from contamination during storage and delivery.
   c. Admixtures: Protect stored admixtures against contamination, evaporation, or damage. Provide agitating equipment for admixtures used in the form of suspensions or nonstable solutions to ensure thorough distribution of the ingredients. Protect liquid admixtures from freezing and from temperature changes which would adversely affect their characteristics.

2.5 ADMIXTURES

A. Concrete supplier and Precast Fabricator shall certify compatibility of all ingredients in each mix design. Use admixtures in strict accordance with manufacturer's recommendations.

B. Concrete supplier and Precast Fabricator shall account for admixture volume in the concrete mix proportions in accordance with admixture manufacturer's recommendations.

C. Prohibited Admixtures: Calcium chloride or admixtures containing more than 0.15% chloride ions or other salts, by weight of admixture, are not permitted. Additionally, each admixture shall not contribute more than 5 PPM, by weight, of chloride ions to total concrete constituents.

D. Use water-reducing admixture or high-range water-reducing admixture (super plasticizer) in concrete as required for placement and workability.

E. Use high-range water-reducing admixture (HRWR) in pumped concrete, and for concrete with water/cement ratio of 0.45 or less.

F. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of +/- 1%

G. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

H. Water-Reducing Admixture: ASTM C494, Type A.

I. Retarding Admixture: ASTM C494, Type B.

J. Water-Reducing and Retarding Admixture: ASTM C494, Type D.

K. High Range Water-Reducing Admixture (Super plasticizer): ASTM C494, Type F.

L. High Range Water Reducing and Retarding Admixture (Super plasticizer), ASTM C494 Type G.

M. Silica Fume Admixture: ASTM C1240

N. Non-Chloride, Non-Corrosive Water-Reducing, Accelerating Admixture: ASTM C494, Type C or E.

O. Corrosion Inhibiting Admixture capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete: Add at a rate which shall inhibit corrosion to 9.9 lb of chloride ions per cu. yd of concrete.

P. Shrinkage Reducing Admixture to reduce the drying shrinkage in concrete members: Dosage to be at 1.5 gal./cubic yard of concrete and shall conform to ASTM C157, maximum drying shrinkage level of 0.04%.

2.6 THIN BRICK

A. Thin Brick Units: ASTM C 1088, Grade SW, Type TBX, not less than 3/4 inch thick, and as follows:
   1. Face Size: Standard, 2-1/4 in. high by 7-5/8 in. long.
   2. Special Shapes: Include corners, edge corners, and end edge corners.
   3. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
   4. Surface Coloring: Brick with surface coloring, other than flashed or sand-finished brick, shall withstand 50 cycles of freezing and thawing per ASTM C67 with no observable difference in the applied finish when viewed from 10 ft.
   5. Brick Coating: Wax or nox-crete brick coating shall be applied to each brick face to facilitate the cleaning of the cast brick surfaces. Do not allow coating to contact back of brick during manufacture, shipping or handing.

B. Provide thin brick matching color, texture, and face size of existing brick work.
   1. Summitville #10 red bricks

2.7 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A36.

B. Carbon-Steel-Headed Studs: ASTM A108, Grade 1010 through 1020, cold finished, AWS D1.1, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.

C. Malleable-Iron Castings: ASTM A47.

D. Deformed-Steel Wire or Bar Anchors: ASTM A496 or ASTM A706.

E. Carbon-Steel Bolts and Studs: ASTM A307, Grade A; carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A563; and flat, unhardened steel washers, ASTM F844.

F. High-Strength Bolts and Nuts: ASTM A325 or ASTM A490, Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A563; and hardened carbon-steel washers, ASTM F436.
   1. Do not zinc coat ASTM A490 bolts.

G. Zinc-Coated Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A123 or ASTM A153.
   1. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with MPI #18, MPI #19, or SSPC-Paint 20.
   2. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.

H. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3, and shop apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79 according to SSPC-PA 1.

I. Welding Electrodes: Comply with AWS standards.

J. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install precast structural concrete units.

2.8 STAINLESS STEEL CONNECTION MATERIALS

A. Stainless-Steel Plate: ASTM A666, Type 304.

B. Stainless-Steel Bolts and Studs: ASTM F593, Alloy Group 1 or 2, hex-head bolts and studs; ASTM F594, Alloy Group 1 or 2 stainless-steel nuts; and flat, stainless-steel washers.
   1. Lubricate threaded parts of stainless-steel bolts with an anti-seize thread lubricant during assembly.

C. Stainless-Steel-Headed Studs: ASTM A276, Alloy 304, with minimum mechanical properties of PCI MNL-116.

2.9 BEARING PADS

1. Elastomeric Pads: AASHTO M251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size from a molded sheet, 70 +/- Shore A durometer, minimum tensile strength 2250 psi per ASTM D412.
2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer.
3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered, cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer.
4. Shims for Bearing Pads:
   a. Galvanized or epoxy-coated ASTM A36 steel. Do not stack shims more than three high. Tack weld multiple shims together on at least two

faces or corners. Touch up galvanizing or epoxy coating damaged by welding.

b. High-density plastic.

2.10 ACCESSORIES

A. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install structural precast concrete units.

B. Backer Rod for Grouted and Sealed Joints: See Division 07.

2.11 GROUT MATERIALS

A. 8,000 psi minimum compressive strength at 28 days.

B. Sand-Cement Grout: Portland cement, ASTM C150, Type I, and clean, natural sand, ASTM C144. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, of consistency suitable for application. Subject to compliance with requirements, provide one of following, or approved equivalent:
1. "Hi-Flow Grout" by The Euclid Chemical Company.
2. "Masterflow 928" by Master Builders.

D. Epoxy Grout: ASTM C881, 2-component epoxy resin, of type, grade, and class to suit requirements.

2.12 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by laboratory trial mix or field test data bases, as follows:
1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
2. Compressive Strength (28 Days):
   a. f'c = 6,000 psi for columns and shear wall members
   b. f'c = 5,000 psi for double tees, beams, and any members other than columns or shear walls.
3. Slump: Tested in accordance with ASTM C143
   a. 2 – 3 in. before addition of water reducing admixtures.
   b. 6 – 10 in. after addition of water reducing admixtures.
4. Water-Cementitious Materials Ratio: 0.40 maximum.
5. Air Content: Total entrained air content of 6% with a tolerance of +/- 1%.
   a. The air void system of the hardened concrete shall have a spacing factor of 0.0080 in. maximum, a specific surface of 600 sq. in. per cubic in., and the number of air voids per in. shall be 1-1/2 to 2 times the numerical value of the entrained air content percentage, as determined by ASTM C457.

B. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at Precast Fabricator's option.

C. Cementitious Materials:

1. For concrete exposed to deicers, limit percentage, by total weight, of cementitious materials other than Portland cement according to ACI 301 Section 4.2.2.8 requirements.
2. Limit percentage by weight, in aggregate, of cementitious material:
   a. Combined Fly Ash and Pozzolans: not to exceed 25% of total cementitious weight.
   b. Ground Granulated Blast-Furnace Slag: not to exceed 50% of total cementitious weight.
   c. Silica Fume: not to exceed 7% of total cementitious weight.
   d. Combined Fly Ash, Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: not to exceed 50% of total cementitious weight; Portland cement shall be 50% of total cementitious weight minimum; fly ash or pozzolans shall not exceed 25% and silica fume shall not exceed 7% of total cementitious weight.

D. Chloride Ion Content of Mix:
1. Water soluble chloride ion content of mix (including all constituents) shall not exceed 0.06% chloride ions by weight of cement for prestressed concrete and 0.15% for reinforced concrete.
2. Concrete chloride ion content shall be determined by Testing Agency, according to ASTM C1218, prior to placement. Cast samples from current production of concrete mix proposed for Project.
3. Use of calcium chloride or admixtures containing chloride ions is not permitted.

E. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing admixture or high-range water-reducing admixture (super plasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use high range water-reducing admixture in pumped concrete, concrete for parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio of 0.45 or less.
4. Use corrosion-inhibiting admixture in concrete mixes for all driving surfaces.
5. Use polypropylene/polyethylene synthetic structural fiber in concrete mixtures where indicated.

F. SER's acceptance of mix design shall not relieve Precast Fabricator from responsibility for any variation from requirements of Contract Documents unless Precast Fabricator has in writing called SER's attention to each such variation at time of submission and SER has given written approval of each such variation.

G. Adjustment to Concrete Mixes: Mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant, as accepted by SER/Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by SER/Architect before using for Project.

2.13 THIN-BRICK FACINGS

A. Place form-liner templates accurately to provide grid for thin-brick facings. Provide solid backing and supports to maintain stability of liners while placing thin bricks and during concrete placement.

B. Securely place thin-brick units face down into form-liner pockets and place concrete backing mixture.

C. Completely fill joint cavities between thin-brick units with sand-cement mortar, and place precast concrete backing mixture while sand-cement mortar is still fluid enough to ensure bond.

D. Mix and install pointing grout according to ANSI A108.10. Completely fill joint cavities between thin-brick units with pointing grout, and compress into place without spreading pointing grout onto faces of thin-brick units. Remove excess pointing grout immediately to prevent staining of thin brick.
   1. Tool joints to a slightly concave shape when pointing grout is thumbprint hard.

E. Clean faces and joints of thin-brick facing.

2.14 FABRICATION

A. Fabricate precast structural concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL-116 product dimension tolerances as well as position tolerances for cast-in items.

B. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
   1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

C. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.

D. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.

E. Cast in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.

F. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
   1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
   2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
   3. Place reinforcing steel and prestressing strand to maintain at least 3/4 in. minimum concrete cover. Increase cover requirements for reinforcing steel to 1 1/2 in. when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports

to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.

4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

G. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

H. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL-116.
1. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete unit.
2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.

I. Comply with requirements in PCI MNL-116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

J. After stripping, keep precast pieces in surface damp condition at minimum temperature of 50°F. Protect pieces from exposure to weather until strength of concrete has reached 3,500 psi minimum. Do not ship precast pieces to the Project site until piece can safely support all imposed handling stress.

K. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

L. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
1. Place backup concrete mixture to ensure bond with face-mixture concrete.

M. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL-116.
1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.

N. Comply with PCI MNL-116 procedures for hot- and cold-weather concrete placement.

O. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop

Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that does not show in finished structure.

1. Locate lift loops and erection inserts so as not to be visible in completed construction. Provide all lift loops and erection inserts with 1-1/2 in. minimum non-shrink cover in completed construction. Any left loops or erection inserts that must be located in areas that will be exposed to public view in completed construction shall be recessed and patched with minimum of 1-1/2 in. dry-pack, latex-modified concrete grout.

P. Cure concrete, according to requirements in PCI MNL-116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

Q. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL-116 and meet Architect's approval.

R. Welding:
1. Use proper preheat for welding high-strength steels.
2. Welding processes shall not reduce cross-sectional area of concrete reinforcement.
3. Obtain prior written authorization of the SER for welding concrete reinforcement.
4. Conform to AWS procedures when welding galvanized steel pieces.

S. Architectural Precast Finishes
1. Finish exposed-face surfaces of precast concrete units to match Architect’s reference sample and as follows:
   a. PCI and APA's "Architectural Precast Concrete – Color and Texture Selection Guide," of plate numbers indicated, except with aggregate size of 1/2-inch, as specified above.
      1. Exposed Aggregate: No. 347 R-M.
      2. Sand-Blast Finish: No. 348 SB-L.
   b. Retarded Finish: Use chemical retarding agents applied to concrete forms and washing and brushing procedures to expose aggregate and surrounding matrix surfaces after form removal.
   c. Sand-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.

T. Structural Precast Finishes:
1. Finish surfaces of precast structural concrete in accordance with PCI MNL-116 as indicated for each type of unit and as follows:
   a. Standard Formed Finish: Normal plant-run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls will be tolerated. Major or unsightly imperfections, honeycombs, or structural defects are not permitted.
   b. Commercial Formed Finish: Remove fins and large protrusions and fill large holes. Rub or grind ragged edges. Faces are to be true, well-defined surfaces.
   c. Grade B Formed Finish: Fill air pockets and holes larger than 1/4 in. in diameter with sand-cement paste matching color of adjacent surfaces. Grind smooth form offsets or fins larger than 1/8 in.

d. Grade A Formed Finish: Fill air pockets and holes larger than 1/4 in. in diameter with sand-cement paste matching color of precast concrete. Grind smooth form offsets or fins larger than 1/8 in. Float-apply a neat cement-paste coating to exposed surfaces. Rub dried paste coat with burlap to remove loose particles
e. Screed finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections.
1. Substitute: Precast Fabricator may substitute steel trowel finish for unformed surfaced with written approval of SER/Architect.
(a) Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.

2. Formed Surfaces: Grade B finish
3. Unformed Surfaces: Screed finish
4. Columns: Face unformed surface, screed finish, toward inside of parking structure.
5. Spandrel Beams:
a. Interior face: Screed finish, or textured finish per accepted sample.
b. Exterior face, ends, bottom and top: smooth dense surface standard finish.
6. Double Tees:
a. Tee areas without cast-in-place concrete topping:
1. Top surface shall have medium broom finish in longitudinal direction.
2. All sides, ends and bottom: Smooth dense standard finish.
b. Top surface of block outs for pour strips: After initial strike-off, transversely scarify/rake surface to provide ridges with approximately 1/4 in. depth minimum to insure bond of topping.
c. Depressor holes: Filled with non-shrink, non-staining grout.
7. Wall panels: Screed finish.

U. Patching: Minor patching in the plant will be acceptable provided that the structural adequacy of the product and the appearance is not impaired. Cosmetic patching of other members will be allowed only after the Architect's approval of methods and workmen to be used. All patching shall be done by the Precast Fabricator. Limitations as to amount of cosmetic patching that will be permitted are subject to acceptance of Architect.

V. Manufacturing Tolerances:
1. Tolerances for manufacture and erection of precast concrete are not cumulative.
2. Tolerances for manufacture of precast-concrete pieces shall be in accordance with the following:
a. PCI MNL-116.
b. PCI MNL-117.
c. PCI MNL-135.

2.15 SOURCE QUALITY CONTROL

A. Testing: Test and inspect precast structural concrete according to PCI MNL-116 requirements and ASTM C1610, ASTM C1611, ASTM C1621, and ASTM C1712.
1. Test and inspect self-consolidating concrete according to PCI TR-6.

B. Strength of precast structural concrete units is considered deficient if units fail to comply with PCI MNL-116 requirements, including the following:
   1. Units fail to comply with compressive-strength test requirements.
   2. Units fail to comply with entrained air content test requirements.
   3. Reinforcement and prestressed tendons of units do not comply with fabrication requirements.
   4. Concrete curing and protection of units against extremes in temperature fail the comply with requirements.
   5. Units are damaged during handling and erection.

C. If there is evidence that strength of precast concrete units may be deficient or may not comply with compressive-strength requirements, employ a qualified testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C42.
   1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by SER/Architect.
   2. Test cores in an air-dry condition or, if units are wet under service conditions, test cores after immersion in water in a wet condition.
   3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
   4. Report test results in writing on same day that tests are performed, with copies to Architect, Contractor, and Precast Fabricator. Test reports include the following:
      a. Project identification name and number.
      b. Date when tests were performed.
      c. Name of Precast Fabricator.
      d. Name of concrete testing agency.
   5. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

D. Patching: If core test results are satisfactory and precast structural concrete units comply with requirements, clean and dampen core holes and solidly fill with same precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

E. Dimensional Tolerances: Units with dimensions smaller or larger than required and not complying with tolerance limits may be subject to additional testing.
   1. Precast concrete units with dimensions larger than required will be rejected if the appearance or function of the structure is adversely affected or if larger dimensions interfere with other construction. Repair or remove and replace rejected units, as required, to comply with construction conditions.

F. Quality control: Precast Fabricator's Quality Control inspector shall inspect all pieces immediately after pieces have received final finish.

G. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.

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

3.2 ERECTION

A. Erection of precast concrete shall be performed by workers skilled in this Work under direction of supervisor with at least 5 years' experience in erecting precast work similar to that of this Project. Preapproval of superintendent subject to approval of the Owner and SER/Architect.

B. All precast-concrete pieces shall have twenty-eight-day specified strength before permanent welded or cast-in-place-concrete connections are made to those pieces. Maintain adequate support and bracing at all times.

C. Lift pieces with suitable equipment at lifting points provided by Precast Fabricator.

D. Temporarily guy and brace the erected structure in accordance with the approved Erection Plan.

E. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.

F. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, shoring, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.
   1. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.

G. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

H. Field cutting of precast units is not permitted without approval of SER/Architect and Precast Fabricator/Designer.

I. Fasteners: Inserts or anchors required for support of the work of other trades shall be installed in a manner that protects the precast units from damage. No drilling or installation of power-driven fasteners may be undertaken in precast/prestressed units without prior acceptance by the Architect and SER.

J. Welding: Field welding shall be performed by certified welding operators only, using equipment and materials compatible with the base material. Methods and materials shall be in accordance with AWS D1.1, AWS D1.4 and AWS D1.6.
   1. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
   2. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and apply coat of galvanized repair paint to galvanized surfaces.

3. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.

K. Grouting Connections and Joints: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings.
1. Provide forms or other approved method to retain grout in place until hard enough to support itself.
2. Pack spaces with non-shrink, dry-pack grout material, tamping until voids are completely filled.
3. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces.
4. Fill joints completely without seepage to other surfaces.
5. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.
6. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
7. Keep grouted joints damp for not less than 24 hours after initial set.

L. Erection Tolerances: Erect precast-concrete pieces to noncumulative tolerances indicated in Article 10 of PCI MNL-135.

3.3 FIELD QUALITY CONTROL

A. As pieces arrive at jobsite, Construction Manager's Quality Control inspector shall check the production control tag for each piece to verify that the piece is complete and correct.

B. Any defective work that cannot be repaired to satisfaction of SER/Architect, whether found on site or at shop at any time before completion and acceptance of Project, will be rejected regardless of previous reviews and shall be remade or reconstructed to satisfaction of SER/Architect. However, finishes accepted at shop will not be rejected at site.

C. Improperly located bearing pads or those incorrect materials will not be accepted by SER/Architect and shall be relocated or modified at expense of Precast Fabricator or Erector, regardless of when rejected.

D. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections during erection of precast units.
1. Testing Agency has authority to reject materials, welds, connections and precast pieces not meeting Specifications.
2. Testing Agency will report test results promptly and in writing to Construction Manager, SER/Architect, and Precast Erector.

E. Visually inspect field welds and test according to ASTM E165 or to ASTM E709 and ASTM E1444. High-strength bolted connections are subject to inspections.

3.4 REPAIRS

A. Repair precast structural concrete units if permitted by Architect.
1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of

demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 ft.

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A780.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Architect.

3.5 CLEANING

A. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
   1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
   2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

B. At completion of Work or at such times as directed by SER/Architect, remove all rejected and surplus material, rubbish, or apparatus from premises and deliver Work in a clean and sound condition to the satisfaction of the SER/Architect.

END OF SECTION

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SECTION 04 20 00

UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Miscellaneous masonry accessories.

B. Related Sections:
1. Division 03 Precast Concrete sections for thin brick facing.
2. Section 05 50 00 "Metal Fabrications" for furnishing steel lintels for unit masonry.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced (Engineered) Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.
1. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.4 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
3. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.
4. Prism Test: For each type of construction required, according to ASTM C 1314.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Locations of expansion joints.

C. Samples for Verification: For each type and color of the following:
   1. Exposed CMUs.
   2. Accessories embedded in masonry.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a. Include data on material properties.
   2. Cementitious materials. Include brand, type, and name of manufacturer.
   3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   4. Grout mixes. Include description of type and proportions of ingredients.
   5. Reinforcing bars.
   6. Joint reinforcement.
   7. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
   2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

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

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

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

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

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 Specifications for Masonry Structures, current editions, unless modified by requirements in the Contract Documents.

E. Special Inspection: The concrete unit masonry will have Special Inspection as required by IBC 2009. The Owner will provide Special Inspection for the project.
   1. Special Inspection is required of CMU as required by IBC 2009 Table 1704.5.1 "Level 1 Special Inspection".
   2. The Contractor is to coordinate and provide advanced notice to the Special Inspector of reinforced concrete masonry.
   3. The Special Inspection Agency will provide written reports according to IBC 1704.1.2 to the Owner, Contractor, Architect, and Structural Engineer.

F. Fire Resistive Ratings:
   1. Where masonry construction is indicated on Drawings or required by code to have fire resistant construction, provide masonry material and methods in manner to obtain the necessary rating.
   2. Provide materials and construction identical to those of assemblies with the indicated fire resistance ratings as determined per UL 263 and tested by testing and inspecting agency, or as manufactured in accordance with UL 683 of equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

G. Provide welding accordance with AWS, Standard Code for Arc and Gas Welding in Building Construction, current edition.

H. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01 40 00 "Quality Requirements" for mockups.
   1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness.
   2. Locate panels in the locations indicated or, if not indicated, as directed by Architect.
   3. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
   4. Clean exposed faces of panels with masonry cleaner indicated.
   5. Protect approved sample panels from the elements with weather-resistant membrane.
   6. Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
   7. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
      a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.
   8. Demolish and remove sample panels when directed.

I. Mockups: Before installing unit masonry build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Locate mockups in the locations indicated, if not indicated as directed by Architect.
   2. Build mockup of typical wall area as shown on Drawings.

3. Build mockups for each type of exposed unit masonry construction in sizes approximately 60 inches (1500 mm) long by 72 inches (1800 mm) high by full thickness, including face and backup wythes and accessories.
   a. Include a sealant-filled joint at least 16 inches (400 mm) long in each mockup.
4. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
5. Clean exposed faces of mockups with masonry cleaner as indicated.
6. Protect accepted mockups from the elements with weather-resistant membrane.
7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
8. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
   a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
   b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
9. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

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

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

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

1.9 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.

2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

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

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

D. Cold-Weather Requirements / Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602, but not less than the following:
1. Receive, store, and protect construction materials in ways that prevent water from entering the materials.
2. If climatic conditions warrant, measure temperatures of construction materials. Thaw frozen sand and wet masonry units. Heat masonry units below 20 deg F to above 20 deg F without overheating.
3. Heat sufficient mortar ingredients to produce mortar temperatures between 40 deg F and 120 deg F. Make every effort to produce consecutive batches of mortar with the same temperatures falling within this range. Provide mortar temperature after mixing and before use above 40 deg F maintainable either by auxiliary heaters under the mortar board or by more frequent mixing of mortar batches. Do not allow heated mortar on mortar boards to become excessively hot (greater than 120 deg F).
4. During below normal temperatures, place masonry only on sound unfrozen foundations. Do not place masonry on snow or ice covered surface, because of the danger of movement when the base thaws and the possibility of very little bond being developed between the mortar and the supporting surface.
5. At the end of each day, or during a shutdown, protect the top surface of all masonry to prevent moisture as rain, snow or sleet from entering the masonry. Provide protection cover on the wall top surface and extend a minimum of 2 feet down all sides of the masonry and secure in place to prevent blowing off.
6. Work Day Temperatures/Construction Requirements/Protection:
   a. Above 40 deg F: Use normal masonry procedures.
      1) Cover walls with plastic or canvas at end of work day to prevent water entering masonry.
   b. 40 deg F to 32 deg F: Heat mixing water to produce mortar temperatures between 40 deg F to 120 deg F.
      1) Cover walls and materials to prevent wetting and freezing. Covers should be plastic or canvas.

c. 32 deg F to 25 deg F: Heat mixing water and sand to produce mortar temperatures between 40 deg F to 120 deg F.
   1) With wind velocities over 15 mph provide wind breaks during the work day and cover walls and materials at the end of the work day to prevent wetting and freezing. Maintain masonry above freezing for 16 hours using auxiliary heat or insulated blankets.
d. 25 deg F to 20 deg F: Maintain mortar on boards above 40 deg F.
e. 20 deg F to 0 deg F and below: Heat mixing water and sand to produce mortar temperatures between 40 deg F to 120 deg F.

7. Provide enclosures and supply sufficient heat to maintain masonry enclosure above 32 deg F for 24 hours.
8. Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
2. When ambient temperature exceeds 100 deg F(38 deg C), or 90 deg F(32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Recycled Content: Provide concrete masonry unit products with an average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Basis of Design Manufacturer: Subject to compliance with the requirements, provide Brampton Brick Concrete Masonry Unit with CarbonCure, or comparable products by another manufacturer acceptable to the Architect.
1. Additional Accepted Manufacturer: A.Jandris, Gardner, MA

C. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

D. CMUs: ASTM C 90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength indicated on the structural drawings.
2. Density Classification: Normal weight unless otherwise indicated.
3. Size (Width): Manufactured to the following dimensions:
   a. 4 inches (100 mm) nominal; 3-5/8 inches (92 mm) actual.
   b. 6 inches (150 mm) nominal; 5-5/8 inches (143 mm) actual.
   c. 8 inches (200 mm) nominal; 7-5/8 inches (194 mm) actual.
   d. 10 inches (250 mm) nominal; 9-5/8 inches (244 mm) actual.
   e. 12 inches (300 mm) nominal; 11-5/8 inches (295 mm) actual.
   f. 16 inches (400 mm) nominal; 15-5/8 inches (396 mm) actual.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.3 CONCRETE AND MASONRY LINTELS

A. General: Provide one of the following:

B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than CMUs.

C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime-Aggregate Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type II, hydrated lime complying with ASTM C 207, and aggregate complying with ASTM C 144.
1. Utilize factory preblended mortar and grout mixes from manufacturers capable of providing computer controlled products including batch information relating to the approximate weights of each individual raw material utilized in the mixtures. Use of field prepared mortar and grout mixes that incorporate damp loose aggregate is prohibited.

D. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

E. Aggregate for Grout: ASTM C 404.

F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Euclid Chemical Company (The); Accelguard 80.
      b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
      c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

G. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
   1. Interior Walls: Hot-dip galvanized, carbon steel.
   2. Exterior Walls: Hot-dip galvanized, carbon steel.
   3. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
   4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
   5. Wire Size for Veneer Ties: 0.148-inch (3.77-mm) diameter.
   6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
   7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
   1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
   2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304 or Type 316.
   3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
   4. Stainless-Steel Sheet: ASTM A 666, Type 304 or Type 316.

B. Corrugated Metal Ties: Not acceptable.

C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.

D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.
   1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units.

2. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm).
3. Wire: Fabricate from 3/16-inch (4.76 mm) diameter, hot-dip galvanized steel wire. Mill-galvanized wire ties may be used in interior walls unless otherwise indicated.

E. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame:
   a. Weld-on Straps: For masonry ties, 0.11-inch (2.8 mm) by 3/4 inch (19 mm) wide by 5-inch (126 mm) by 9-inch (228 mm) long, hot-dip galvanized steel. Provide one of the following:
      1) Hohmann & Barnard, Inc, No. 359H.
      2) Dur-O-Wall, Inc., No. D/A 207.
      3) Heckmann Building Products, Inc., No. 315-B.
   b. Weld-on Channel Slots: For masonry ties, 0.060 inch (1.5 mm) x 1-3/8 inch (35 mm) wide by 1/2 inch (12.7 mm) deep by 5, 8 or 10 feet (1524, 2438 or 3048 mm) long, hot-dip galvanized steel, with standard slots. Provide one of the following:
      1) Hohmann & Barnard, Inc, No. 360.
      2) Dur-O-Wall, Inc., No. D/A 904.
      3) Heckmann Building Products, Inc., No. 133.
2. Tie Section for Anchors Welded to Steel Frame:
   a. Adjustable Wire Anchors (For attachment to weld-on straps): 3/16 inch (4.76 mm) diameter, hot-dip galvanized ASTM A-153, Class B-2, cold drawn steel wire, ASTM A-82, configurations as noted on the Drawings, length as required to provide embedment within 1 inch (25 mm) of masonry face. Provide one of the following:
      1) Triangular Anchors:
         a) Hohmann & Barnard, Inc., No. VBT.
         b) Dur-O-Wal, Inc., No. D/A 701-708.
         c) Heckman Building Products, Inc., No. 316.
      2) Web Ties (Blunt End):
         a) Hohmann & Barnard, Inc , No. 320W
         b) Dur-O-Wal, Inc., No. D/A 750.
         c) Heckman Building Products, Inc., No. 318-B.
   b. Adjustable Strap and Wire Anchors (For attachment to weld-on channel slots):
      1) Strap Anchors: 1-1/4 inch (31 mm) wide, 0.060-inch (1.5 mm) thick, hot-dip galvanized ASTM A-153, Class B-2, length as required to provide embedment within 1 inch (25 mm) of masonry face. Provide one of the following:
         a) Hohmann & Barnard, Inc., No. 364.
         b) Dur-O-Wal, Inc., No. 931.
         c) Heckman Building Products, Inc., No. 134.
      2) Triangular Wire Anchors: 3/16 inch (4.76 mm) diameter, hot-dip galvanized ASTM A-153, Class B-2, 1.5 oz. (42.5 g), cold drain steel wire, ASTM A 82, configurations as noted on the Drawings, length as required to provide embedment within 1 inch (25 mm) of masonry face. Provide one of the following:

a) Hohmann & Barnard, Inc., No. 363.
b) Dur-O-Wal, Inc., No. 918-921.
c) Heckman Building Products, Inc., No. 123.

F. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 01.05-inch- (2.66-mm-) thick, steel sheet, galvanized after fabrication.
2. Tie Section: Triangular Wire Anchors: 3/16 inch (4.76 mm) diameter, hot-dip galvanized ASTM A 153, Class B-2, 1.5 oz. (42.5 g), cold drain steel wire, ASTM A 82, configurations as noted on the Drawings, length as required to provide embedment within 1 inch (25 mm) of masonry face. Provide one of the following:
a. Hohmann & Barnard, Inc., No. 363.
b. Dur-O-Wal, Inc., No. 918-921.
c. Heckman Building Products, Inc., No. 123.
3. Partition Top anchors: 0.105-inch- (2.66-mm-) thick metal plate with 3/8-inch- (9.5-mm-) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

2.7 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch (0.86-mm), galvanized steel sheet.

C. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

D. Postinstalled Anchors: Torque-controlled expansion anchors.
1. Load Capacity: 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.
2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 unless otherwise indicated.
3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Column Wrap: 1/8" Ethafoam; Polyethylene foam.

2.9 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Diedrich Technologies, Inc.
      b. EaCo Chem, Inc.
      c. ProSoCo, Inc.

2.10 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime mortar unless otherwise indicated.
   3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For masonry below grade or in contact with earth, use Type S.
   2. For reinforced masonry, use Type N.
   3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
3. Provide grout with a slump of 10 to 11 inches (254 to 279 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

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

3.2 INSTALLATION, GENERAL

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

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

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

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

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

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).

2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:
1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

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

A. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

1. Running bond, with vertical joint in each course centered on units in courses above and below, if not otherwise indicated.
2. Stack bond, where indicated.
3. As indicated on Drawings.

B. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2-inches (50-mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

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

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

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

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

G. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 46 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

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

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

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
   1. For glazed masonry units, use a nonmetallic jointer 3/4 inch (19 mm) or more in width.

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

3.6 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
   1. Space reinforcement not more than 16 inches (406 mm) o.c.
   2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

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

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units in accordance with the manufacturer’s printed instructions for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
   1. Provide an open space not less than 1 inch (25 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
      a. Install column wrap between masonry and structural members.
   2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.
   4. Clean and repair galvanizing at welded anchors to comply with ASTM A70.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry where indicated and not to exceed 20-feet on center and 10-feet from corners. Build-in related items as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 "Joint Sealants," but not less than 3/8 inch (10 mm).
1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry and where indicated.

3.9 LINTELS

A. Install steel lintels where indicated.

B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.10 REINFORCED (ENGINEERED)UNIT MASONRY INSTALLATION

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

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

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

D. Low Lift Grouting Method: Provide low lift grouting as the laying of masonry and placement of reinforcement progresses.
1. Place the first lift up to 16 inches height, but limit all subsequent pours to maximum 12 inches lifts, placed before masonry coursing is 24 inches higher than preceding pour. Allow setting mortar to cure at least 4 hours prior to grouting of cells in adjacent hollow masonry units.

2. Provide grout keys by terminating grout lifts a minimum of 1-1/2 inch below mortar joints or 1-1/2 inches above bed joint when one course is laid above horizontal reinforcing.
3. Consolidate each grout lift with a rod to provide uniform flow into all spaces of voids.
4. Place grout in cells up to top masonry course at a maximum 48 inches height above preceding pour.

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Special Inspections: Level 1 special inspections according to the "International Building Code."
1. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.

C. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
1. Test six (6) sample concrete masonry units for each class of masonry unit used in the construction taken from stored units on the site.
2. Perform two (2) tests on individual masonry units for each floor level of masonry constructed.
3. Tests are to include average moisture content, percent of total absorption, weight and compressive strength.

D. Mortar Test (Property Specification):
1. Provide tests which indicate compressive strength, water retention and flow. Tests in accordance with ASTM C 109, ASTM C 110, ASTM C 780 and ASTM C 1586.
2. Perform tests for each type mortar and for each day mortar is used. For compressive strength, test four 2 inch cubes; one cube at 24 hours, one at three (3) days, one at seven (7) days and one at 28 days.
3. Test for the water soluble alkali content of the cement used in the mortar in accordance with ASTM C 114, or suitable certification furnished by the manufacturer of the cement, to establish that total water soluble alkali content does not exceed 0.1 percent of the alkalis present.

E. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

F. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.
1. Perform prism tests consisting of three (3) prisms each in the field from materials currently in use.
2. Prepare and cure test specimens in accordance with ASTM C 1019.
3. Perform one (1) set of tests for each 2,000 sq. ft. of wall area, or fraction thereof, of reinforced unit masonry during the course of the construction.

3.12 REPAIRING, POINTING, AND CLEANING

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

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

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

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   5. Clean masonry with a proprietary cleaner applied according to manufacturer's written instructions.
   6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.13 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Dispose of non-salvageable masonry waste as required by Section 01 74 19 "Construction Waste Management."

END OF SECTION

SECTION 05 01 70.61

DECORATIVE METAL REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes decorative metal repairs as follows:
   1. Repairing metal and replacing damaged and missing components in place.
   2. Removing metal for shop repair and replacement of components; reinstalling repaired metal.
   3. Painting steel uncovered during the Work.

B. Related Requirements:
   1. Section 05 52 13 "Pipe and Tube Railings" for new metal railing construction.
   2. Section 10 82 13 "Exterior Grilles and Screens" for new exterior grilles and screens.

1.2 DEFINITIONS

A. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

B. Medium-Pressure Spray: 400 to 800 psi (2750 to 5510 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

C. High-Pressure Spray: 800 to 1200 psi (5510 to 8250 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include recommendations for product application and use.
   2. Include test data substantiating that products comply with requirements.

B. Shop Drawings:
   1. Include plans, elevations, and sections showing locations and extent of repair and replacement work, with enlarged details of replacement parts indicating materials, profiles, methods of attachment, accessory items, and finishes.
   2. Include field-verified dimensions and the following:
      a. Identification of each new metal item and component and its location on the structure in annotated plans and elevations.
      b. Provisions for expansion, weep holes, and conduits as required for each location and exposure.
      c. Provisions for sealant joints if required.

C. Samples for Initial Selection: For the following:
   1. Each type of decorative metal item and component with applied finishes.
   2. Sealant materials.
   3. Accessories to verify color selection.

D. Samples for Verification: For the following products in manufacturer's standard sizes unless otherwise indicated, finished as required for use in the Work:
   1. Each type of new material to be used for replacing existing or missing decorative metal; 6 inches (150 mm) long in least dimension or whole item.
   2. Fittings and brackets.
   3. Each type of exposed connection between components. Show method of finishing components at connections.
   4. Each type of exposed finish prepared on metal of the same alloy to be used for the Work of this Section; 6 inches (150 mm) long in least dimension.
   5. Sealant materials.
   6. Accessories: Each type of anchor, accessory, and miscellaneous support in required finishes.

E. Delegated-Design Submittal: For [**structural performance of repaired railings, handrails, and anchors**] <**Insert item**>, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For decorative metal repair specialist.

B. Evaluation Reports: For post-installed structural anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Decorative Metal Repair Specialist Qualifications: A qualified decorative metal fabrication and repair specialist. Experience installing and finishing new decorative metalwork is insufficient experience for repairing decorative metal.

B. Mockups: Prepare mockups of decorative metal repair processes on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation. Prepare mockups so they are inconspicuous.
   1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Pack, deliver, and store decorative metal items in suitable packs, heavy-duty cartons, or wooden crates; surround with sufficient packing material to ensure that products are not deformed, cracked, or otherwise damaged.

B. Store decorative metal inside a well-ventilated area, away from uncured concrete and masonry and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

C. Protect strippable protective covering on decorative metal from exposure to sunlight and high humidity, except to the extent necessary for the period of decorative metal installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with decorative metal repairs only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.

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 post-installed structural anchors.

B. Structural Performance: Railings and handrails, 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. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
2. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
3. Uniform and concentrated loads need not be assumed to act concurrently.

2.2 METAL MATERIALS

A. General: Provide decorative metal materials made of the alloys, forms, and types that match existing metals and have the ability to receive finishes matching existing finishes unless otherwise indicated. Exposed-to-view surfaces exhibiting imperfections inconsistent with existing materials are unacceptable.

B. Source Limitation for Replacement Cast Materials: Obtain castings for decorative metal repair from single source from single manufacturer with resources to provide materials of consistent quality in appearance and physical properties.

C. Aluminum: Alloy and temper recommended in writing by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required:
1. Extruded Bars and Shapes: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
2. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M, Alloy 6063-T6.
3. Drawn General-Purpose Seamless Tubes: ASTM B 210 (ASTM B 210M), Alloy 6063-T832.
4. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
5. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.
6. Castings: ASTM B 26/B 26M, Alloy A356-T6.

D. Steel: Standard and grade designated below for each form required:
   1. Tubing: Cold formed, ASTM A 500/A 500M.
   2. Steel Plate, Shapes, and Bars: ASTM A 36/A 36M.
   3. Steel Bars: Mild steel; ASTM A 29/A 29M, Grade 1010.
   4. Steel Sheet: ASTM A 1008/A 1008M, cold-rolled commercial steel sheet; matte finish; suitable for exposed applications.

2.3 PREPARATORY CLEANING MATERIALS

A. Water: Potable.

B. Hot Water: Water heated to a temperature of 140 to 160 deg F (60 to 71 deg C).

C. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every 5 gal. (20 L) of solution required.

D. Abrasive Materials:
   1. Blasting Abrasive: Powdered aluminum silicate.
   2. Abrasives for Ferrous Metal Cleaning: Aluminum oxide paper, emery paper, fine steel wool, steel scrapers, and steel-wire brushes of various sizes.

E. Rust Remover: Manufacturer's standard phosphoric acid-based gel formulation, also called "naval jelly," for removing corrosion from iron and steel.

F. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer according to SSPC-Paint 20 or SSPC-Paint 29.
   1. Surface Preparation: Use coating requiring no better than SSPC-SP 2, "Hand Tool Cleaning" surface preparation according to manufacturer's literature or certified statement.
   2. VOC Limit: Use coating with a VOC content of 400 g/L (3.3 lb/gal.) or less.

2.4 FASTENERS

A. Fasteners: Fasteners of the same basic metal as fastened metal unless otherwise indicated. Use metals that are noncorrosive and compatible with each metal joined.
   1. Match existing fasteners in material and in type of fastener unless otherwise indicated.
   2. Use concealed fasteners for interconnecting decorative metal components and for attaching them to other work unless exposed fasteners are unavoidable or the existing fastening method.
   3. For exposed fasteners, use Phillips-type machine screws of head profile flush with metal surface unless otherwise indicated.
   4. Finish heads of exposed fasteners to match finish of metal fastened unless otherwise indicated.

B. Anchors, General: Use bolt heads of same basic metal as fastened metal unless otherwise indicated. Use metals that are noncorrosive and compatible with each metal anchored.

C. Post-Installed Structural Anchors: Fastener systems; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to

authorities having jurisdiction, based on ICC-ES AC01 AC193 AC58 or AC308 as appropriate for the substrate.

1. Uses: Securing railings to concrete.
2. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

D. Post-Installed Nonstructural Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 AC193 AC58 or AC308 as appropriate for the substrate.

1. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.5 MISCELLANEOUS MATERIALS

A. Welding Electrodes and Filler Metal: Select according to AWS specifications for metal alloy welded; use metal type and alloy as recommended in writing by producer of metal to be welded or filled and as required for color match, strength, and compatibility in fabricated items.

B. Metal-Patching Compound: Two-part, polyester-resin metal-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of metal repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be produced for filling metal that has deteriorated because of corrosion. Filler shall be capable of filling deep holes and spreading to feather edge.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended in writing by manufacturer for interior and exterior applications.

D. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer for exterior use.

E. Sealant Materials:

1. Provide manufacturer's standard, elastomeric single-component, nonsag, neutral-curing silicone sealant complying with applicable requirements in Section 07 92 00 "Joint Sealants."
2. Colors: Provide colors of exposed sealants to match colors of metals in which sealant is placed unless otherwise indicated.

F. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, glazed masonry, and polished stone surfaces from damaging effects of acidic and alkaline cleaners.

G. Masking Tape: Nonstaining, nonabsorbent material; compatible with chemical solutions being used and substrate surfaces, and that will easily come off entirely, including adhesive.

H. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
   1. Previous effectiveness in performing the work involved.
   2. Little possibility of damaging exposed surfaces.
   3. Consistency of each application.
   4. Uniformity of the resulting overall appearance.
   5. Do not use products or tools that could do the following:
      a. Remove, alter, or in any way harm the present or future condition of existing surfaces, including surrounding surfaces not in the Contract.
      b. Leave an unintended residue on surfaces.

2.6 METAL FABRICATION

A. Fabricate repairs of decorative metal items and components in sizes and profiles to match existing decorative metal, with accurate curves, lines, and angles. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.

B. Provide uniform, neat seams with minimum exposure of welds, brazing, solder, and sealant.

C. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for fasteners. Use concealed fasteners where possible; use exposed fasteners to match existing work.

D. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of flux, and dress exposed and contact surfaces.
   1. Use materials and methods that match color of base metal, minimize distortion, and develop maximum strength and corrosion resistance.
   2. Remove flux immediately.
   3. At exposed connections, match contours of adjoining surfaces, and finish exposed surfaces smooth and blended so no roughness shows after finishing.

E. Castings: Fabricate castings free of warp, cracks, blowholes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks.
   1. Finish castings to match existing decorative metalwork.
   2. Replacement Casting for Handrail Bracket: Duplicate existing handrail bracket on the cast-iron railing of first-floor stairs in the lobby. Make molds from this bracket to create new cast-iron brackets.

2.7 FINISHES, GENERAL

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

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Mill finish.

B. Clear Anodic Finish: AAMA 611, [Class I, 0.018 mm] [Class II, 0.010 mm] or thicker over a [satin (directionally textured)] [polished (buffed)] [nonspecular as fabricated] <Insert requirement> mechanical finish.

C. Color Anodic Finish: AAMA 611, [Class I, 0.018 mm] [Class II, 0.010 mm] or thicker over a [satin (directionally textured)] [polished (buffed)] [nonspecular as fabricated] <Insert requirement> mechanical finish.

D. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

2.9 FERROUS METAL FINISHES

A. Repair Primer: Manufacturer's standard, rust-inhibiting, fast-curing, lead- and chromate-free universal primer, compatible with firmly adhered existing paint and applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 PROTECTION

A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
   1. Cover adjacent surfaces with materials that are proved to resist chemical solutions being used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
   2. Do not apply chemical solutions during winds of enough force to spread them to unprotected surfaces.
   3. Neutralize alkaline and acid wastes before disposal.
   4. Dispose of runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

3.2 DECORATIVE METAL REPAIR, GENERAL

A. Repair Appearance Standard: Repaired surfaces are to have a uniform appearance as viewed from 20 feet (6 m) away by Architect.

B. Execution of the Work: In repairing items, disturb remaining existing work as minimally as possible and as follows:
   1. Stabilize decorative metal to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
   2. Remove deteriorated coatings and corrosion.
   3. Sequence work to minimize time before protective coatings are reapplied.
   4. Repair items where stabilization is insufficient to stop progress of deterioration.
   5. Repair items in place where possible.
   6. Replace or reproduce items where indicated or scheduled.
   7. Install temporary protective measures to stabilize decorative metal that is indicated to be repaired later.

C. Mechanical Coating Removal: Use gentle methods, such as scraping and wire brushing, that will not abrade metal substrate.

D. Repair Decorative Metal Item: Match existing materials and features.
   1. Repair decorative metals by patching, piecing-in, splicing, or otherwise reinforcing metals with new metal matching existing metal.

E. Replace Decorative Metal Component: Where indicated, duplicate and replace items with new metal matching existing metal.
   1. Replace heavily deteriorated or missing parts or features of decorative metal with compatible materials, using surviving prototypes to create patterns or molds for duplicate replacements.

3.3 PREPARATORY CLEANING

A. General: Use those methods indicated for each type of decorative metal and its location.
   1. Brushes: If using wire brushes, use brushes of same base metal composition as metal being cleaned. Use brushes that are resistant to chemicals being used.
   2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that spray methods do not damage surfaces.
      a. Equip units with pressure gages.
      b. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
      c. For high-pressure water-spray application, use fan-shaped spray that disperses water at an angle of at least 40 degrees.
      d. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F (60 and 71 deg C) at flow rates indicated.
   3. Uniformity: Perform each cleaning method in a manner that results in uniform coverage of all surfaces, including corners, contours, and interstices, and that produces an even effect without streaks or damaging surfaces.

4. Protection: After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

B. Water Cleaning: Clean with cold or hot water applied by low or medium-pressure spray. Supplement with natural-fiber or plastic-bristle brush. Use small brushes to remove soil from joints and crevices.

C. Detergent Cleaning:
1. Wet surface with cold or hot water applied by low-pressure spray.
2. Scrub surface with detergent solution and natural-fiber or plastic-bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
3. Rinse with cold water applied by low or medium-pressure spray to remove detergent solution and soil.

D. Cleaning by Abrasive Blasting: Clean surfaces to remove dirt by dry blasting with specified blasting abrasive at pressure and distance from surface indicated below. Do not rinse ferrous metals with water; wipe with damp cloths to remove residue.
1. Pressure and Distance from Surface: As established by mockup.

E. Chemical Rust Removal:
1. Remove loose rust scale with approved abrasives for ferrous metal cleaning.
2. Apply rust remover with brushes or as recommended in writing by manufacturer.
3. Allow rust remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing. Do not allow extended dwell time.
4. Wipe off residue with mineral spirits and either steel wool or soft rags, or clean with method recommended in writing by manufacturer to remove residue.
5. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
6. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.

F. Mechanical Rust Removal:
1. Remove rust with approved abrasives for ferrous metal cleaning.
2. Wipe off residue with mineral spirits and either steel wool or soft rags.
3. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
4. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.

3.4 REMOVAL, REPAIR, AND REINSTALLATION

A. General: Perform removal work as required in Section 02 41 19 "Selective Demolition" for specific requirements relating to selectively demolishing construction, including decorative metal removal for repair or reinstallation elsewhere.

B. Defects in Painted Metal Surfaces: Repair nonload-bearing defects in existing metal surfaces, including dents and gouges more than 1/8 inch (3 mm) deep or 1/2 inch (13 mm) across, and all holes and cracks by filling with metal-patching compound

and sanding smooth. Remove burrs and protruding fasteners. Prime iron and steel surfaces immediately after repair to prevent flash rusting.

C. Reinstalling Posts: After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8-inch (3-mm) buildup sloped away from post.

D. Installing Sealant:
1. After metal reinstallation, keep joints to receive sealant dry and free of debris.
2. Clean and prepare joint surfaces according to Section 07 92 00 "Joint Sealants." Prime joint surfaces unless sealant manufacturer recommends against priming. Do not allow primer to spill or migrate onto adjoining surfaces.
3. Fill sealant joints with specified joint sealant as recommended in writing by sealant manufacturer and according to Section 07 92 00 "Joint Sealants" and the following:
   a. Install sealant using only proved installation methods that ensure sealant is deposited in a uniform, continuous ribbon, without gaps or air pockets, and with complete wetting of the joint bond surfaces equally on both sides. Fill joint flush with surrounding metal.
   b. Do not allow sealant to overflow or spill onto adjoining surfaces or to migrate into the voids of adjoining surfaces, particularly rough or sculptural textures. Promptly remove excess and spillage of sealant as the work progresses. Clean adjoining surfaces by means necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes, as demonstrated in an approved mockup.
4. Cure sealant according to Section 07 92 00 "Joint Sealants."

3.5 PRIMING

A. Repair Primer: Apply immediately after completing a repair.

3.6 PAINTING STEEL UNCOVERED DURING THE WORK

A. Notify Architect if steel is exposed during metal removal. Where Architect determines that the steel is structural, or for other reasons cannot be totally removed, prepare and paint it as follows:
1. Surface Preparation: Remove paint, rust, and other contaminants according to SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," as applicable to comply with paint manufacturer's recommended preparation.
2. Antirust Coating: Immediately paint exposed steel with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended rate of application (dry film thickness per coat).

B. If on inspection and rust removal, the thickness of a steel member is found to be reduced from rust by more than 1/16 inch (1.6 mm), notify Architect before proceeding.

3.7 DECORATIVE METAL REPAIR SCHEDULE

A. Items indicated on the Drawings:
   1. Repair: Replace broken and damaged components and repaint railing.
   2. Finish: Section 09 91 13 "Exterior Painting" or Section 09 96 00 High Performance Coatings, as indicated on the Drawings,

END OF SECTION

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SECTION 05 12 00

STRUCTURAL STEEL FRAMING

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.

B. Refer to other Divisions of these Specifications to determine the type and extent of work therein affecting the work of this trade, whether or not such work is specifically mentioned in this Section.

1.2 SUMMARY

A. The Work includes labor, materials, equipment, and services required for completion of Work under this Section as shown on Drawings and as specified here.

B. The work under this Section includes but is not limited to the following:
1. Structural steel and connections not specifically detailed on the Drawings.
2. Architecturally Exposed Structural Steel (AESS).
3. Steel deck support angles.
4. Shop-installed headed shear stud connectors.
5. Shop priming and/or painting of steel material.
6. Hot-dip-galvanizing of steel material.
7. Post-installed mechanical and adhesive anchors.

C. Related Sections include the following:
1. Section 01 33 00 – Submittal Procedures.
2. Section 03 30 00 – Cast-in-Place Concrete.
3. Section 05 31 00 – Metal Decking, for field installation of shear connectors.
4. Section 05 50 00 – Metal Fabrications, for miscellaneous steel fabrications not defined as structural steel.
5. Section 05 51 13 – Metal Stairs, for metal stair assemblies.
6. Section 07 81 00 – Applied Fireproofing, for surface preparation for structural steel to be fireproofed.
7. Section 09 91 00 – Painting and Coating, for surface preparation and priming requirements.

D. Work furnished under this Section and installed under other Sections:
1. Section 03 30 00 – Cast-in-Place Concrete, for installation of structural shapes, bolts, angles, plates, and inserts embedded in new concrete.

E. The Contractor has sole responsibility for site safety. The Fabricator and Erector shall review the Contract Documents, and if the structure, as shown on those documents, is in conflict with the requirements of any safety regulations, the Fabricator shall notify the Architect before commencing production of shop drawings. If the Fabricator and/or Erector fail to notify the Architect, as stated

above, they shall become responsible for all costs for correcting such conflicts with the requirements of any and all safety regulations.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's Code of Standard Practice for Steel Buildings and Bridges, that support design loads.

B. Special Inspector: Personnel performing Owner-provided testing and inspections as specified and as required by 2015 International Building Code (IBC).

C. Fabricator's Engineer: Professional Structural Engineer licensed in the State where the Work will be erected permanently, responsible for the structural design of connections.

D. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.

1.4 PERFORMANCE REQUIREMENTS

A. Detailing: Detail structural members, connections, accessories, and temporary components required for transportation and erection.
   1. Refer to Architectural Details for miscellaneous items, tolerances, and provisions to be made for the attachment of other materials.
   2. Where indicated as requiring coordination, refer to approved mechanical shop drawings for exact location and dimensions of supports for mechanical equipment and penetrations.

B. Connections: Design and detail all connections not specifically detailed on the Contract Documents to withstand loads indicated and comply with concepts, prescriptions, and restrictions indicated. Column splices and beam end connections shall comply with the structural integrity requirements of Section 1615.3.2 of the 2015 IBC.
   1. Where appropriate, select and complete connections using schematic details indicated and AISC's Manual of Steel Construction, Fourteenth Edition, Part 9, Load and Resistance Factor Design.
   2. Engineering Responsibility: Fabricator's responsibilities include having a qualified Professional Engineer registered in the State of Maine prepare structural analysis and design data for structural steel connections.

C. Construction: FR (fully restrained) and simple connections, as indicated on the Drawings.

1.5 SUBMITTALS

A. Make submittals in compliance with Division 1 Section 01 33 00 – Submittal Procedures.

B. International Code Council Evaluation Service Reports: For each type of product indicated where a product other than that specified in Construction Documents is proposed for use. Use shall be subject to Engineer's approval.
   1. Expansion anchors.
   2. Adhesive anchors.

C. Product Data: For each type of product indicated, including, but not limited to, the following:
   1. Expansion anchors.
   2. Adhesive anchors.
   3. Welding filler metals and fluxes.
   4. Galvanizing repair paint.

D. Erection Plan: The Contractor shall submit a structural steel erection plan prepared by a professional engineer licensed in the State of Maine. The structural steel frame is dependent upon installation and attachment of the floor and roof diaphragms for lateral stability. The erection plan shall address temporary stability of the steel structure prior to deck installation and attachment.

E. Shop Drawings: Show fabrication of structural-steel components.
   1. Before submitting shop drawings to the Architect, precheck the shop drawings for conformity of details to the Contract Documents and coordination with other work. Include signature of Contractor's representative indicating that the Drawings have been prechecked. The Contractor is wholly responsible for the conformity of dimensions and details of the shop drawings to the Contract Documents.
   2. Prior to the submittal of any erection drawings, calculations, or details, submit a schedule of the anticipated submittal sequence. This schedule will be discussed at the predetailing conference.
   3. Prior to the submittal of any steel shop drawings, submit an informational submittal containing an accurate survey of the existing steel structure.
   4. The Contractor shall make all submittals in electronic PDF file format and shall include the Structural Engineer of Record's (SER) submittal review stamp in each PDF file. The SER will only return PDF files to the Contractor.
   5. Submit fabricator standard connection details (i.e. bolt sizes and configurations, weld sizes and configurations, connection materials, etc.) and calculations for review and approval by the SER **prior to** submitting piece drawings. Shop drawings submitted prior to job standard connection details and calculations will not be reviewed or returned until the connection details are reviewed and approved. Include structural analysis data, signed and sealed by the Fabricator's Engineer responsible for their preparation, substantiating the connection designs. The Fabricator's Engineer designing connections shall be a Professional Engineer licensed in the State of Maine. Submit connection information in tabular format showing the following:
      a. Weld sizes.
      b. Sizes and material of connecting elements.
      c. Number, size, type of bolt, and bolt hole size.
      d. Material; minimum thickness of supporting member part.
      e. Material and minimum thickness of supported member part.
      f. Connection strength (LRFD capacity).
   6. Submit erection drawings before detail drawings. **Do not** submit piece drawings before erection drawings have been reviewed, approved, and returned by the SER. Erection drawings shall indicate field welds between new and existing structural steel and shall include a welding procedure for such welds.
   7. Include on piece drawings:
      a. Details and dimensions of all pieces.
      b. Steel material designation.

c. Surface preparation and finish.
d. Details of all cuts, connections, splices, camber, holes, welds, bolts, and other pertinent data.
e. Identification marks indicating which erection drawings show each piece.
f. SER's shop drawing review stamp.
g. Detail drawings shall include no more than one piece per drawing and shall be no larger than 11 in. x 17 in.

8. Include embedment drawings.
9. Prepare details that avoid interference of steel connections, gussets, and bracing elements with architectural details, shaft openings, and wall openings.
10. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
11. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength-bolted connections.
12. Approval of the shop drawings is for size and arrangement of principal and auxiliary members and general conformance. Approval by SER does not relieve the Contractor's responsibility for dimensions, fabrications, and correct fitting of structural members.
13. Resubmitted Drawings:
    a. Clearly and individually identify all changes in resubmitted shop drawings by clouding, whether the change results from a review comment or not.
    b. Date and identify each shop drawing issue.
    c. Identify each shop drawing by the same drawing number throughout the duration of the project.

F. Connection Design Affidavits:
1. Immediately upon submission of job standard connection details, submit an affidavit prepared by the Fabricator's Engineer, whose signature, seal, and registration number shall appear on the affidavit, stating the following: "All connections and details required to resist the loads and reactions shown on the Contract Drawings and as specified, excepting those completely designed and detailed on the Contract Documents, will be designed by me personally or by qualified personnel under my direct supervision."
2. At the completion of the work, the same licensed Professional Engineer shall submit an affidavit stating the following: "All connections and details required to resist the loads and reactions shown on the Contract Drawings and as specified, excepting those completely designed and detailed on the Contract Documents, have been designed by me personally or by qualified personnel under my direct supervision."

G. Construction Forces Imposed on Base Building Structure by Temporary Attachments:
1. Provide drawings and structural analysis for temporary bracing of cranes, hoists, or any other equipment imposing loads on the base building structure during construction. Drawings and supporting calculations shall be signed and sealed by a Professional Engineer licensed in the State of Maine. Such drawings shall indicate the loads imposed on the base building structure.

H. Welding Procedure Specifications, including Qualification Test Reports for welds qualified by test, for each class of weld to be incorporated in the work.

I. Ultrasonic weld inspection reports in accordance with ASTM A435 for all complete joint penetration welds.

J. Welding certificates for shop welders and field welders.

K. Qualification Data: For fabricator.

L. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
   1. Structural steel including chemical and physical properties.
   2. Anchor rods.
   3. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
   4. Tension-control, high-strength bolt-nut-washer assemblies.
   5. Shop-installed headed shear-stud connectors.
   6. Shop primers.

M. Source quality-control test reports.

N. Galvanizing: Submit an original and two copies of the coating applicator's notarized Certificate of Compliance that the hot-dip-galvanized coating meets or exceeds the specified requirements of ASTM A123 or A153 as applicable.

O. Fabrication and Erection Errors: Notify SER of fabrication or erection errors requiring field work. Before performing corrective work, submit a description of the proposed corrective field work for review and approval.

1.6 QUALITY ASSURANCE

A. Erector Qualifications: A qualified erector who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CASE. The erector shall have a minimum of 5 yrs of experience in the satisfactory erection of structural steel on projects of this magnitude and complexity.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU. The Fabricator shall have a minimum of 5 yrs of experience in the satisfactory fabrication of structural steel on projects of this magnitude and complexity.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P2 or SSPC-QP 3 – Standard Procedure for Evaluating Qualifications of Shop Painting Applicators.

D. Galvanizing Applicators: Company specializing in hot-dip galvanizing after fabrications and following the procedures of the Quality Assurance Manual of the American Galvanizers Association.

E. Welding: Qualify procedures and shop and field personnel according to AWS D1.1-10 – Structural Welding Code – Steel.

F. Comply with applicable provisions of the following specifications and documents as amended herein:
   1. American Institute of Steel Construction:
      a. AISC 303-10 – Code of Standard Practice for Steel Buildings and Bridges – 14 April 2010:

1) Section 3.3, Second Paragraph: Delete first sentence and replace with "When discrepancies exist between the Design Drawings and Specifications, the more restrictive requirement shall govern unless otherwise agreed to by the Architect, subject to the general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections."
2) Section 4.1, First Sentence: Delete "complete" and insert "showing in sufficient detail the scope of Work items" after "Specifications."
3) Section 4.1: Delete the second sentence.
4) Section 4.3, Second Sentence: After "following conditions", add "as amended and/or superseded by the agreement with the Owner's Designated Representative for Design."
5) Section 4.3: Replace every occurrence of "CAD" with "digital."
6) Section 4.4, Second Paragraph: Replace "with" with "prior to."
7) Section 4.4, Third Paragraph: Delete the first sentence.
8) Section 4.4.2: Delete this section in its entirety and replace with "Comments and markings or lack thereof on shop drawings or submissions do not constitute an express or implied change to the Contract Documents."
9) Section 6.5: Insert before the first sentence "Unless otherwise noted on the Contract Documents."
10) Section 7.10.3: Delete the second sentence of the first paragraph and replace it with "The Erector shall have the sole responsibility for determining the means and methods used to properly and adequately temporarily brace the framing during erection."
11) Section 7.11.1: Delete second sentence and replace it with "The erector shall coordinate with the General Contractor the installation and removal of all safety protection."
12) Section 7.14: Delete in its entirety.
13) Section 7.14: In the second sentence, delete "most efficient and economical."
14) Section 9.1.1: Delete "completely."
15) Section 9.3: Delete in its entirety.
16) Section 10.2.5: Delete in its entirety.
17) Section 10.2.8: Delete in its entirety.
18) Appendix A: Delete in its entirety.

b. AISC 360-10 – Specification for Structural Steel Buildings.

2. Research Council on Structural Connections: Specification for Structural Joints Using High Strength Bolts, 2009.
3. American Welding Society: AWS D1.1-2010 –Structural Welding Code – Steel.
4. Society for Protective Coatings: Steel Structures Painting Manual, Vol. 2.
5. American Galvanizers Association: Inspection of Products Hot-Dip Galvanized After Fabrication.

G. Mockups: Build mockups of architecturally exposed structural steel to set quality standards for fabrication and installation.
1. Coordinate finish painting requirements with Sections in Division 9: Painting and Intumescent Paints.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

H. The Owner shall employ a Special Inspector to oversee and administer, and an independent Testing Agency(s) to perform, a Program of Structural Tests and Inspections for compliance with Chapter 17 of the 2015 IBC. The SER has prepared a statement of structural tests and inspections specifying the tests and inspections to be performed throughout the construction of this project. Submission to and approval of this statement by the local building official must be complete prior to beginning construction.
   1. The Special Inspector will organize and direct the test and inspection program. All inspection and test reports shall be submitted to the Contractor, Construction Manager (CM), the Owner's Representative, and the SER within 48 hrs of each inspection visit. The Contractor shall be responsible for understanding the test and inspection program and notifying the Testing Agency and the Special Inspector when work is ready for tests and/or inspections. The Contractor will provide access to the Testing Agency, Special Inspector, and the SER. Inspections and tests of the Structural Tests and Inspection Program will not relieve the Contractor of responsibility for supervision, testing, and inspection for quality control of the work.
   2. The Testing Agency and Special Inspector shall submit written reports to the Contractor, Construction Manager (CM), the Owner's Representative, and the SER within two business days of all inspections that describe any construction that does not conform to the Contract Documents. The Special Inspector shall re-inspect all nonconforming construction after the Contractor has corrected the nonconforming construction and prepare a written report of the re-inspection within two business days of the re-inspection.
   3. The Owner's Representative will provide testing and inspection reports to the local building official when so requested. Upon completion of the construction, the Special Inspector will make a final report on the satisfactory completion of the Program for Structural Tests and Inspection to the building official and to the Owner's Representative.

I. Fabrication and Erections Errors: Notify Engineer of fabrication or erection errors requiring field work. Before performing corrective work, submit description of field work for review and approval.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Store fasteners in a protected place. Refer to RCSC's Specification for Structural Joints Using High Strength Bolts, Section 2.2, and associated commentary for more information on the storage of fastener components. The SER may require that improperly stored fasteners be discarded.
   2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
   3. Load and store galvanized articles in accordance with accepted industry standards.

1.8 COORDINATION

A. Furnish anchorage and embedded structural steel items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.9 PRE-INSTALLATION CONFERENCES

A. Pre-detailing Conference: The conference shall be held at least thirty days before the first submission of shop drawings. The conference may be held via conference call at the SER's discretion.
   1. Agenda to include, but not be limited to, the following:
      a. Sequencing and schedule of submissions.
      b. Connection calculations.
      c. Connection details.
      d. Procedures for review of submissions.
      e. Detailing procedures and preferences.
      f. Welding procedures including welding new structural steel to existing structural steel.
      g. Submission procedures.
      h. RFI procedures.
      i. Fabrication procedures and preferences.
      j. Specification and design drawing requirements.
   2. Predetailing conference attendees include, but are not limited to, the following:
      a. Contractor.
      b. Contractor's Superintendent.
      c. Contractor's Assistant Superintendent or equivalent responsible for the structural steel.
      d. Fabricator's representative.
      e. Representative of Professional Engineer performing connection calculations.
      f. Architect.
      g. Structural Engineer of Record.
      h. Owner's representative.

B. Pre-erection Conference: The conference shall be held at least 30 days prior to the start of erection. Conduct the conference at Project site to comply with requirements in Division 01 Section 01 31 00 – Project Management and Coordination.
   1. Agenda to cover, but not be limited to, the following:
      a. Survey of existing stair tower.
      b. Embedded structural steel conditions including surveyed locations.
      c. Erection bracing procedures.
      d. Welding procedures, welder qualifications, and welding new structural steel to existing structural steel.
      e. Bolting procedures.
      f. Methods, equipment, and sequencing of erection.
      g. Special Inspections and testing.
      h. Metal deck and head shear-stud connector installation.
      i. Contractor's quality control procedures.
      j. Procedures for addressing corrective measures in field.

2. Pre-erection conference attendees include, but are not limited to, the following:
   a. Contractor.
   b. Contractor's Superintendent.
   c. Contractor's steel assistant superintendent or equivalent.
   d. Fabricator's representative.
   e. Steel erector's representative.
   f. Metal deck erectors representative (if different from steel erector).
   g. Architect.
   h. Structural Engineer of Record.
   i. Special Inspector and representative of the Testing Agency.
   j. Owner's Representative.

C. The Contractor is to record, type, and distribute minutes of meeting to all attendees within five business days.

D. The Contractor shall notify attendees at least ten days before the scheduled date of the conference.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.

B. Channels, Angles, Shapes: ASTM A36/A36M or ASTM A572 Grade 50 as indicated.

C. Plate and Bar: ASTM A36/A36M (or ASTM A572/A572M, Grade 50 where noted on Drawings).

D. Cold-Formed Hollow Structural Sections:
   1. Square and Rectangular Shapes: ASTM A500, Grade B, or ASTM A1085 structural tubing.
   2. Round Shapes: ASTM A500, Grade B

E. Steel Pipe: ASTM A53/A53M, Type E or S, Grade B. Weight Class: As indicated. Finish: Black, except where indicated to be galvanized.

F. Welding electrodes for all moment frames and complete joint penetration welds: Provide minimum Charpy V-Notch toughness of 20 ft-lbs at 0°F.
   1. Innershield NR-203Ni1, Innershield NR-232, Innershield NR-311Ni (for the corresponding application/position) as manufactured by Lincoln Electric
   2. Approved equal with same or higher notch toughness.

G. Other Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, or ASTM A490, Type 1, heavy-hex steel structural bolts; ASTM A563 heavy-hex carbon-steel nuts, Grade DH; and ASTM F436 hardened carbon-steel washers.
   1. Finish: Plain (or hot-dip zinc coating, ASTM A153/A153M, Class C where noted on Drawings).
   2. Tap nuts after galvanizing to minimum diametral amounts in ASTM A563.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F1852, Type 1, heavy-hex head steel structural bolts with splined ends; ASTM A563 heavy-hex carbon-steel nuts, Grade DH; and ASTM F436 hardened carbon-steel washers.
   a. Plain unless joining components indicated as galvanized.
   b. Galvanized Finish: Mechanically deposited zinc coating, ASTM B695, Class 50.

C. Shop-Installed Headed Shear-Stud Connectors: ASTM A108, Grades 1015 through 1020, headed shear-stud type, cold-finished carbon steel; AWS D1.1, Type B.

D. Threaded Rods: A572/A572M, Grade 50.
   1. Nuts: ASTM A563, Grade A, heavy-hex carbon steel.
   2. Washers: ASTM A36/A36M carbon steel.
   3. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

2.3 Expansion Anchors

A. Available Products: Provide one of the following:
   1. ITW Ramset/Red Head Trubolt Wedge.
   2. Hilti Kwik Bolt III.

B. Finish:
   1. Stainless Steel with Chemical Composition of AISI 304 or 316.

2.4 Hot-dip zinc coating, ASTM A153/A153M, Class C.ADHESIVE ANCHORS

A. Available Products: Provide one of the following:
   1. Hilti HIT-HY 200 System.
   2. Hilti RE 500-SD System.
   3. Epcon Ceramic 6.

B. Rods:
   1. Stainless steel with chemical composition of AISI 304 or 316 as indicated.

C. Hot-dip zinc coating, ASTM A153/A153M, Class C.Nuts and Washers: Match rod material.

2.5 PRIMER

A. Primer: SSPC-Paint 25, Type II, iron oxide, zinc oxide, raw linseed oil, and alkyd. Faying surfaces that are indicated to be slip critical, mask area for primer or provide primer that will provide a Class A faying surface.

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's Code of Standard Practice for Steel Buildings and Bridges, and AISC's Specification for Structural Steel Buildings.
   1. Identify high-strength structural steel according to ASTM A6/A6M and maintain markings until structural steel has been erected.
   2. Mark and match-mark materials for field assembly.
   3. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Architecturally Exposed Structural Steel (AESS): Comply with fabrication requirements, including tolerance limits, of AISC's latest Code of Standard Practice for Steel Buildings and Bridges (AISC 303-16) for structural steel identified as architecturally exposed structural steel.
   1. All members shall comply with the fabrication and finish requirements of AESS 3.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2 – Hand Tool Cleaning.

F. Shop-Installed Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
   1. Cut, drill, or punch bolt holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's Specification for Structural Joints Using ASTM A325 or A490 Bolts for type of bolt and type of joint specified.
   1. Joint Type: Typical joints shall be snug-tightened. Where indicated, joints shall be pretensioned or slip critical with Class A faying surfaces.
   2. Do not reuse high-strength bolts that have previously been pretensioned.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds, and for methods used in correcting welding work.
   1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's Code of Standard Practice for Steel Buildings and Bridges for mill material.

2.8 SURFACE PREPARATION

A. Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. Members Indicated as AESS: Prepare per SSPC-SP6 – Commercial Blast Cleaning for steels to receive primer compatible with intermediate and top coats as specified in Division 9 for painting and intumescent paint.

2. Members Indicated to Receive Galvanized Finish: Prepare per SSPC-SP6/NACE No. 3 – Commercial Blast Cleaning.
3. Members Indicated to Receive Zinc-Rich Paint: Prepare per SSPC-SP3 – Power Tool Cleaning.
4. Members Not One of the Above: Prepare per SSPC-SP3 – Power Tool Cleaning and prime with primer compatible with intermediate and top coats as specified in Division 9 Section: Interior Painting, except as noted below.

2.9 SHOP PRIMING

A. Shop prime to greatest extent possible.

B. Shop prime steel surfaces except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 in.
2. Areas to be field welded. Hold back primer 6 in. by masking area to be field welded. Touch up in the field after welding.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry-film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe prime corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop primer to surfaces that will be inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.10 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.
1. Coat all items specified as galvanized on Structural Drawings and all exterior loose lintels, lintels, and relieving angles and structural steel exposed to weather by the hot-dip process in molten zinc, producing a continuous coating of uniform thickness weighing not less than 2 oz per square foot of surface.
2. Fabricate structural steel in accordance with Class 1 guidelines as described in AGA's Recommended Details for Galvanized Structures.
3. Fabricate in accordance with the applicable portions of ASTM A143, A384, and A385. Avoid fabrication techniques that could cause distortion and embrittlement of the steel.
4. The Fabricator shall consult with the Architect and hot-dip galvanizer regarding potential problems or potential handling problems during the galvanizing process that may require modification of design before fabrication begins.
5. Coordination between Fabricator and Galvanizer:
   a. Review of approved shop drawings.
   b. Location of holes and lifting lugs for galvanizing.
   c. Avoiding using unsuitable marking paints, grease, oil paint, and other deleterious material.
   d. Removal of welding slag, splatter, anti-splatter compounds, and burrs prior to delivery for galvanizing.

e. Removal of surface contaminants and coating that would not be removable by the normal chemical cleaning process in the galvanizing operation.

6. Provide passivating chromate dip or similar treatment to prevent wet storage stain.
7. Galvanize bolts for connections of galvanized structural shapes and plates. Galvanize separate bolts, nuts, and other fasteners after fabrication, conforming to ASTM A153.
8. Galvanize components after fabrication.
9. Mask areas that will be field welded prior to galvanizing.
10. Fill vent holes and grind smooth after galvanizing. Touch up with galvanizing repair paint.
11. Inspection: Contractor's inspector to check coating mil thickness prior to shipment. Send a certification to the Architect stating that coating satisfies specified requirements.
12. Furnish Notarized Certificate of Compliance with ASTM Standards and Specifications listed here. The certificate must be signed by the galvanizer and contain a detailed description of the material processed. Include in the Certificate information as to the ASTM standard used for the coating.
13. Mark all material specified to be hot-dip galvanized after fabrication with a stamp. The stamp must clearly show the name of the galvanizer, the applicable ASTM specification number, and the number of ounces per square foot of zinc coating applied after fabrication.

B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 Formulated in accordance with ASTM A780.
1. ZRC Cold Galvanizing Compound.
2. Brite Zinc by Brite Products.

2.11 SOURCE QUALITY CONTROL AND ASSURANCE

A. Fabricator shall supervise all shop work per his quality control program. The Contractor's quality control personnel shall supervise all fabrication work.
1. Scrutiny of the quality control and quality control procedures will be performed by the Owner's Testing Agency. The Fabricator and Erector shall cooperate with the Testing Agency and provide the Testing Agency with the Fabricator's written procedural and quality control manuals and records of certification by AISC.
2. The Fabricator shall share with the Testing Agency the results of quality control tests and schedule for repairing defects.
3. Before shipping the completed work, the Fabricator shall consult with the Testing Agency to agree on interpretations of acceptance criteria.
4. Inspect all plate material 3 in. and thicker in accordance with ASTM A 435 (Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates) prior to and after welding.

B. Fabricator's work includes facilitating inspections by the Testing Agency. Furnish upon request, at no cost, the following:
1. A complete set of approved erection drawings and shop drawings.
2. Cutting lists, order lists, material bills, and shipping list.
3. Full and ample means and assistance for testing materials and workmanship, and proper facilities for inspection of the work in the shop.

C. At the completion of fabrication, the Fabricator shall submit a certificate of compliance to the building official stating that the work was performed in accordance with the approved construction documents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of bearing plates, and other embedments, with steel erector present, for compliance with requirements.

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

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated, according to AISC's Code of Standard Practice for Steel Buildings and Bridges and AISC's Specification for Structural Steel Buildings, unless otherwise noted.
   1. Survey all edge-of-slab conditions prior to pouring any elevated concrete slabs and submit survey to EOR for approval.

B. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's Code of Standard Practice for Steel Buildings and Bridges.

C. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

D. Splice members only where indicated.

E. Do not use thermal cutting during erection without prior approval by SER of specific application. Finish thermally cut sections within smoothness limits in AWS D1.1.

F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts where approved by the SER.

G. Field beam penetrations must be cut with a plasma cutter, and all edges must be ground smooth.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's Specification for Structural Joints Using ASTM A325 or A490 Bolts for type of bolt and type of joint specified.
   1. Joint Type: as indicated on the Drawings.
   2. Do not reuse high-strength bolts.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
   1. Comply with AISC's Code of Standard Practice for Steel Buildings and Bridges and AISC's Specification for Structural Steel Buildings for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
   2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's Code of Standard Practice for Steel Buildings and Bridges for mill material.
   3. At moment frames and AESS, remove backing bars or runoff tabs, back gouge, and grind steel smooth.
   4. Grind all galvanizing masking material before making field welds.
   5. Where welding to existing structural steel members, welding must be performed in a controlled manner to prevent failure of the existing structural steel due to heating in the weld-affected zone. Avoid welding perpendicular to the primary stress lines of an existing member. Welds to the existing members should be produced as follows to minimize the amount of the existing member that is heated at any one time:
      a. Intermittent welds perpendicular to the primary stress field: Complete welds in 3 in. max weld segments. Each weld segment should be allowed to cool to the touch prior to welding the next segment.
      b. Continuous welds perpendicular to the primary stress field: Complete welds in 2 in. max weld segments. Each weld segment should be allowed to cool to the touch prior to welding the next segment.
      c. Welds parallel to the primary stress field: Weld new member to the existing member by starting at one end and working toward the other end. Do not start welds at each end work toward the center of the new member.

3.5 FIELD QUALITY CONTROL AND QUALITY ASSURANCE

A. Special Inspection and Testing Agency: The Owner will engage a qualified, independent Special inspector and Testing Agency to perform field tests and inspections and prepare test reports.

B. Inspections and tests performed by the independent Special Inspector and Testing Agency do not relieve the Contractor of the responsibility of control over the quality of the Work.

C. Refer to the Program of Structural Tests and Inspection on the drawings, including, but not limited to, the following items:
   1. Inspection of steel assemblies.
   2. Inspection of bolted connections.
   3. Inspection of welded connections.

4. Inspection of structural steel framing members.
5. Inspection of expansion and adhesive anchors attaching structural steel to concrete elements.

D. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

B. Touchup Painting: Cleaning and touchup painting are specified in Division 09 sections related to painting and intumescent coatings. Apply full coating system to areas where paint has been held back at connections.

3.7 CLEANING

A. Remove and dispose of away from the site erection bolts, erection attachments, temporary lifting lugs, safety barrier supports, and any other auxiliary or temporary steel components that interfere with other work.

END OF SECTION

SECTION 05 31 00

METAL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to other Divisions of these Specifications to determine the type and extent of work therein affecting the work of this trade, whether or not such work is specifically mentioned in this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Roof deck.
2. Composite floor deck.
3. Field-installed headed shear-stud connectors.
4. Furnishing and installing filler plates as noted in the Drawings and as may be required to close gaps between decking and structural steel or concrete.
5. Furnishing and installing end closures, pour stops, and roof drain sump pans.

B. Related Sections include the following:
1. Section 03 30 00 – Cast-in-Place Concrete, for concrete fill and reinforcing steel.
2. Section 05 12 00 – Structural Steel, for shop-welded shear connectors.
3. Section 05 50 00 – Metal Fabrications, for framing deck openings with miscellaneous steel shapes.
4. Section 05 51 13 – Metal Pan Stairs.
5. Section 07 81 00 – Applied Fireproofing, for surface preparation for metal deck to be fireproofed.
6. Section 09 91 00 – Painting, for repair painting of painted deck.

1.3 REFERENCE STANDARDS

A. Comply with the following general specifications for materials and workmanship not otherwise specified:
1. AISI Specification for the Design of Cold-Formed Steel Structural Members.
2. AWS Recommended Welding Practices.
3. SDI Code of Recommended Standard Practice.
4. SDI Specifications and Commentaries for Composite Steel Floor Deck.
5. SDI Specifications and commentaries for Steel Roof Deck.

1.4 SUBMITTALS

A. Product Data: For each type of deck, accessory, fastener, welding material, and product indicated.

B. Shop Drawings:
   1. Submit shop drawings per Section 01 33 00 – Submittal Procedures.
   2. The Contractor shall make all submittals in electronic PDF file format and shall include the Structural Engineer of Record's (SER) submittal review stamp in each PDF file. The SER will only return PDF files to the Contractor.
   3. Precheck the shop drawings prior to submission to the Architect and SER for conformity of details to the Contract Documents and as coordinated with other work. The signature of a representative of the Contractor indicating that the Drawings have been prechecked will be required. The Contractor shall be wholly responsible for the conformity of dimensions and details of the shop drawings to the Contract Documents
   4. Show layout, types, gauges, and marking of all deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.
   5. Show fastening methods for deck units, accessories, closure pieces, fittings, sump pans, and the type and sequence of connections, welds, or screws.
   6. Indicate any single-span conditions requiring shoring.
   7. Show size, location, and spacing of field-welded shear studs.
   8. Approval of shop drawings will be for size and arrangement of units and strength of connections. The Contractor is responsible for accuracy of all dimensions shown on shop drawings.
   9. Do not fabricate units prior to approval of shop drawings by SER.

C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Product Test Reports: From a qualified testing agency indicating that each of the following complies with the requirements of the Contract Documents, based on comprehensive testing of current products:
   1. Mechanical fasteners.

F. Research/Evaluation Reports: Evidence of steel deck's compliance with the 2015 International Building Code, including MEA number.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has a minimum of 3 yrs of experience completing steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Testing Agency Qualifications: An independent testing agency employed by the Owner, acceptable to authorities having jurisdiction, qualified according to ASTM E329 to conduct the testing indicated, as documented according to ASTM E548.

C. Welding: Qualify procedures and personnel according to AWS D1.1 – Structural Welding Code – Steel, and AWS D1.3 – Structural Welding Code – Sheet Steel.

D. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those steel deck units tested for fire resistance per ASTM E119 by a testing and inspection agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's Fire Resistance Directory or from the listings of another testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

E. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's Specification for the Design of Cold-Formed Steel Structural Members.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

C. Clean metal deck and accessories of dust, grease, oils, loose materials, and any other material that impairs the adhesion of insulation and accessories, sprayed-on fireproofing, and concrete.

1.7 COORDINATION

A. Make installed deck finished surface compatible with requirements of sprayed-on deck fireproofing material.

B. Coordinate with General Contractor or Construction Manager for limiting access to deck as required for sprayed-on fireproofing to cure and adhere to the underside of deck.

C. General Contractor or Construction Manager to coordinate installation of shoring if and as required by single-span conditions indicated on the deck shop drawings. The floor deck is designed for two-span conditions without shoring. Single-span conditions may require shoring.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Steel Deck:
   a. BHP Steel Building Products USA Inc.
   b. Consolidated Systems, Inc.
   c. Epic Metals Corp.
   d. Marlyn Steel Products, Inc.
   e. Nucor Corp.; Vulcraft Division.
   f. Roof Deck, Inc.
   g. United Steel Deck division of Canam Group.
   h. Verco Manufacturing Co.
   i. Wheeling Corrugating Co.; Div. of Wheeling-Pittsburgh Steel Corp.
2. Headed-Stud Shear Connectors:
   a. Nelson Stud Welding Company.
3. Floor and Roof-Deck Side-Lap Fasteners:

a. Elco Industries.
b. Hilti.

B. Uncoated Deck Thickness: Conform to SDI Specifications for minimum thickness for the gauge specified.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI Specifications and Commentary for Steel Roof Deck, in SDI Publication No. 31, and the following:
1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 40, G90 zinc coating.
2. Deck Profile: As indicated.
a. Type WR, wide rib.
3. Profile Depth: 1-1/2 in., as indicated on Contract Documents.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Double span or more.
6. Side Laps: Overlapped and fastened with side-lap screws (crimped or button-punched side laps are prohibited).

2.3 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with SDI Specifications and Commentary for Composite Steel Floor Deck, in SDI Publication No. 31, the minimum section properties indicated, and the following:
1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 40, G90 zinc coating.
2. Profile Depth: As indicated.
3. Design Uncoated-Steel Thickness: As indicated.
4. Span Condition: Double span or more.
5. Side Laps: Overlapped and fastened with side-lap screws (crimped or button-punched side laps are prohibited).

2.4 HEADED-STUD SHEAR CONNECTORS

A. Shear Connectors:
1. Nelson Type S3L with Nelson welding process.
2. Approved equivalent complying with the following: ASTM A108, Grades 1010 through 1020, headed-stud type, cold-finished carbon steel, AWS D1.1, Type B.

B. Dimensions: Length and diameter as indicated. Head dimensions to comply with AISC Specifications.

C. Accessories: Provide arc shields (ferrules) specifically designed for welding through hot-dipped galvanized metal deck of the type specified.

2.5 ACCESSORIES

A. General: Provide manufacturer’s standard accessory materials for deck that comply with requirements indicated. Design and provide galvanized sheet steel closures and cover plates as required at columns, to close panels, and at conditions

where panels change direction, abut or end; including perimeters of all stair openings, mechanical openings, slab depressions, and other areas where edge forms are required. Provide miscellaneous light angles to support closures wherever required.

B. Floor and Roof-Deck Side-Lap Fasteners: Corrosion-resistant hexagonal washer head; self-drilling, carbon-steel screws, minimum diameter as indicated.
   1. Dril-Flex by Elco Industries.
   2. Kwik-flex by Hilti.
   3. Approved fastener with same or greater strength, toughness, resistance to hydrogen embrittlement, hydrogen-assisted stress corrosion cracking, and durability.

C. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359 in. design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

D. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

E. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 40,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Code of Standard Practice for overhang and slab depth.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

G. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber flute fillers to fit deck profiles for use at tops of partitions where required for acoustic closure of partitions.

H. Recessed Sump Pans: Single-piece steel sheet, 14 ga minimum thickness, of same material and finish as deck, with 3 in. wide flanges and level recessed pans of 1-1/2 in. minimum depth. For drains, cut holes in the field.

I. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94% zinc dust by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

B. Install deck panels and accessories according to manufacturer's approved shop drawings, applicable specifications and commentary in SDI Code of Standard Practice, manufacturer's written instructions, and requirements in this Section.

C. Install temporary shoring before placing deck panels, if indicated on the shop drawings for single-span conditions or if required to meet deflection limitations.

D. Locate decking bundles to prevent overloading of supporting members.

E. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

F. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

G. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.

H. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.

I. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

J. Field Welding: Perform field welding with prequalified personnel executing prequalified procedures referenced in Quality Assurance Section.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 in. long, and as follows:
   1. Weld Diameter: 5/8 in., nominal.
   2. Weld Spacing: Space welds as indicated, but in no case further apart than 24 in. on center.
   3. Side-Lap and Perimeter-Edge Fastening: As indicated in the Drawings.

B. End Bearing: Install deck ends over supporting frame with a minimum end bearing of
1-1/2 in. on steel and 2 in. on concrete, with end joints as follows:
   1. End Joints: Butted.

C. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12 in. apart with at least one weld at each corner.

D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
   1. Weld Diameter: 5/8 in., nominal.
   2. Weld Spacing: Space and locate welds as indicated in the Drawings.

B. Side-Lap and Perimeter-Edge Fastening: Fasten side laps and perimeter edges of panels as indicated, and as follows:
   1. Mechanically fasten with self-drilling No. 10 diameter or larger carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 in. on steel and 2 in. on concrete, with end joints butted. Do not overlap deck panels.

D. End Joints: Butted.

E. Shear Connectors: Weld shear connectors through deck to supporting frame according to AWS D1.1 and manufacturer's written instructions. Remove and discard arc shields (ferrules) and related debris after welding shear connectors.

F. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

G. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of decking. Weld cover plates at changes in direction of floor-deck panels, unless otherwise indicated.

3.5 FIELD QUALITY CONTROL AND QUALITY ASSURANCE

A. The Owner will employ a Special Inspector and an independent Testing Agency to perform special inspections and testing, and to submit full reports of each inspection and test conducted. The Contractor will provide access to the Special Inspector, the Testing Agency, and the SER, as required. Inspections and tests by the Special Inspector and the Testing Agency will not relieve the Contractor of responsibility for supervision and quality control of the Work. Refer to Structural Special Inspections and Procedures that are part of the drawings for testing and inspection specific requirements.

B. Field welds will be subject to inspection.

C. Headed shear-connector stud welds will be inspected and tested according to AWS D1.1 for stud welding

D. The Special Inspector and the Testing Agency will report results promptly and in writing to Contractor, Architect, and SER within two business days and to the building official upon request.

E. Remove and replace work that does not comply with specified requirements. The Special Inspector and the Testing Agency shall reinspect all nonconforming construction and prepare a written report of the reinspection within two business days of the reinspection.

F. Additional testing and inspecting, at the Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Exterior non-load-bearing wall framing.
2. Soffit framing.
3. Thermal spacer system.
4. Exterior Z furring.
5. Exterior hat furring channels.

B. Related Requirements:
1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 09 21 16.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
3. Section 09 22 16 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Samples for verification: Thermal support system and accessories.

D. Delegated-Design Submittal: For cold-formed steel framing and for thermal spacer system.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

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

D. Product Test Reports: For each listed product, for tests performed by [manufacturer and witnessed by a qualified testing agency] [a qualified testing agency].
1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.
8. Thermal spacer system.

E. Evaluation Reports: For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
1. For non-standard cold-formed steel framing, from ICC-ES.
2. For continuous insulation thermal support system, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

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

C. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

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

E. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

F. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design Manufacturer: Subject to compliance with requirements, provide metal framing products by Clark Dietrich Metal Framing, Mill Certified, or comparable products by one of the following:
   1. Clark Dietrich Metal Framing; a Worthington Industries Company.
   2. MarinoWARE.
   3. SCAFCO Corporation.
   4. Steel Network, Inc. (The).

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing and thermal spacer system 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 deflections greater than the following:
      a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
      b. Soffit Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
   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 (67 deg C).
   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 (13 mm).
   5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
   1. Floor and Roof Systems: AISI S210.
   2. Wall Studs: AISI S211.
   3. Headers: AISI S212.
   4. Lateral Design: AISI S213.

D. 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 acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
   1. Grade: ST33H (ST230H) or ST50H (ST340H) As required by structural performance.
   2. Coating: G90 (Z275) or equivalent.

C. Steel Sheet for Vertical Deflection and DriftClips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: 33 (230) or 50 (340), Class 1 As required by structural performance.
   2. Coating: G90 (Z275).

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
   2. Flange Width: 1-5/8 inches (41 mm) minimum.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
   2. Flange Width: 1-1/4 inches (32 mm) minimum.

C. Vertical Deflection Clips: Manufacturer's standard bypass or headclips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
   1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
      a. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
      b. Flange Width: 1 inch (25 mm) plus twice the design gap for other applications.
   2. Inner Track: Of web depth indicated, and as follows:
      a. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
      b. Flange Width: Dimension equal to sum of outer deflection track flange width plus 1 inch (25 mm).

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

F. Exterior furring: Manufacturer’s standard hat and zee shapes.
   1. Sizes: As indicated.
   2. Minimum Base-Metal Thickness: 0.033 inches.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. 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.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC193 ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.
   1. Uses: Securing cold-formed steel framing to structure.
   2. Type: Torque-controlled expansion anchor Torque-controlled adhesive anchor or adhesive anchor.
   3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
   4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. 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.

F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780/A 780M or SSPC-Paint 20.

B. Cement Grout: Portland cement, ASTM C 150/C 150M, 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.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.8 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.
      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, with screws 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 by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) 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 (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

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

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

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 (6 mm) 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 AISI S200, AISI S202, and 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 (1.6 mm).

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, install according to Shop Drawings, and comply 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 equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

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

H. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

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

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

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

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: 16 inches (406 mm).

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

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Install double deep-leg deflection tracks and anchor outer track to building structure.
   2. Connect vertical deflection clips to bypassing studs and anchor to building structure.
   3. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. 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.

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

3.5 ERECTION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

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

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

3.7 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/A 780M and manufacturer's written instructions.

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

END OF SECTION

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SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for Photovoltaic (PV) equipment. (Alternate)
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Elevator hoist or safety beams.
5. Metal ladders.
6. Metal ships' ladders and pipe crossovers.
7. Metal floor plate and supports.
8. Miscellaneous steel trim indicated on the Drawings.
9. Roof safety anchors.
10. Metal Gates.
11. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:
1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.2 COORDINATION

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 metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Prefabricated building columns.
3. Metal nosings and treads.
4. Paint products.
5. Grout.

B. Shop Drawings: Show fabrication and installation details.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
   2. Shop drawings for work requiring delegated design submittal are to be prepared, and sealed or certified by the qualified professional engineer responsible for their preparation.
   3. Steel Framing and Supports for Photovoltaic (PV) equipment.
   4. Elevator machine beams, hoist beams,.
   5. Shelf angles.
   6. Metal ladders.
   7. Elevator pit sump covers.
   8. Loose steel lintels.

A. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed or certified by the qualified professional engineer responsible for their preparation.

B. Design Calculations: Submit design calculations for the following:
   1. Steel Framing and Supports for Photovoltaic (PV) equipment
   2. Gratings and supports.
   3. Ladders.
   4. Ships ladders and pipe crossovers.
   5. Metal floor plates and supports.
   6. Metal framing and supports.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design, items scheduled including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
   1. Design Calculations: Submit design calculations for the following:
      a. Gratings and supports.

B. Generally retain "Structural Performance of Aluminum Ladders" Paragraph below for aluminum ladders unless Project's structural engineer is required to design building components. Delete if sizes of ladder components are specified or indicated on Drawings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Structural Performance: Provide metal fabrications and connections capable of withstanding the following design loads within limits and under conditions indicated:
   1. Loads: As indicated.
   2. Wind design data is indicated on the Drawings.

E. Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Floors: Uniform load of 125 lbf/sq. ft. (6.00 kN/sq. m) or
   2. Concentrated load of 2000 lbf (8.90 kN), whichever produces the greater stress.
   3. Limit deflection to L/360 between supports.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

E. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

F. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

G. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm).
2. Material: Galvanized steel, ASTM A 653/A 653M,, with G90 (Z275) coating; nominal thickness as required to resist loads.

2.3 METAL BAR GRATINGS

A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."

B. Welded Steel Grating:
1. Bearing Bar Spacing: 11/16 inch (17 mm) o.c.
2. Bearing Bar Depth: 1 inch (25 mm).
3. Bearing Bar Thickness: 3/16 inch (4.8 mm).
4. Crossbar Spacing: 4 inches (102 mm) o.c.
5. Traffic Surface: Plain.
6. Steel Finish: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface, and primed.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.

D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: 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/E 488M, conducted by a qualified independent testing agency.

F. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

G. Post-Installed Anchors: Torque-controlled expansion anchors orchemical anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.5 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that are compatible with Section 09 91 13 "Exterior Painting," Section 09 91 23 Interior Painting," and Section 09 96 00 "High-Performance Coatings."

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams 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 welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts for units installed after concrete is placed.

C. Galvanize exterior miscellaneous framing and supports and where indicated.

D. Prime miscellaneous framing and supports with primer specified in Section 09 96 00 "High-Performance Coatings" where indicated.

2.8 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3.

B. Steel Ladders:
   1. Space siderails 18 inches (457 mm) apart unless otherwise indicated.

2. Siderails: Continuous, 1/2-by-2-1/2-inch (12.7-by-64-mm) steel flat bars, with eased edges.
3. Rungs: 1-inch- (25-mm-) diameter steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
7. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 3/4 inch (19 mm) in least dimension.
8. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
9. Galvanize exterior ladders, including brackets.

2.9 METAL SHIPS' LADDERS AND PIPE CROSSOVERS

A. Provide metal ships' ladders andpipe crossovers where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
1. Treads shall be not less than 5 inches (127 mm) exclusive of nosing or less than 8-1/2 inches (216 mm) including the nosing, and riser height shall be not more than 9-1/2 inches (241 mm).
2. Fabricate ships' ladders andpipe crossovers, including railings from steel.
3. Fabricate treads and platforms from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 3/4 inch (19 mm) in least dimension.
4. Comply with applicable railing requirements in Section 05 52 13 "Pipe and Tube Railings."

B. Galvanize exterior steel ships' ladders and pipe crossovers, including treads, railings, brackets, and fasteners.

2.10 METAL FLOOR PLATE

A. Fabricate from rolled-steel floor plate of thickness indicated below:

B. Provide grating sections where indicated fabricated from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 3/4 inch (19 mm) in least dimension.

C. Provide steel angle supports as indicated.

D. Include steel angle stiffeners, and fixed and removable sections as indicated.

2.11 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

2.12 ROOF SAFETY ANCHORS

A. Subject to compliance with the requirements, provide roof safety anchors manufactured by Pro bell PBE75-0000, Weld down safety anchors.
   1. Material: Steel.
   2. Height: 18 inches.
   3. Finish: Galvanized.

2.13 METAL GATES

A. Fabricate units from steel shapes, tubes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction where indicated.
   2. See Section 08 71 00 “Door Hardware” for hardware.

C. Galvanize steel gates.

2.14 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches (200 mm) unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.15 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

2.16 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide

each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.17 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.18 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with universal shop primer unless primers specified in Section 09 96 00 "High-Performance Coatings" are indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
   1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Items Indicated to Receive Primers Specified in Section 09 96 00 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   3. Other Items: SSPC-SP 3, "Power Tool Cleaning."

E. Shop Priming: Apply shop primer to 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, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded

because of shipping size limitations. 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.

C. Field Welding: Comply with the following requirements:
   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 and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
   1. Cast Aluminum: Heavy coat of bituminous paint.
   2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
   1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the 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 (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting." And Section 09 91 23 "Interior Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION

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SECTION 05 51 13

METAL PAN STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Preassembled steel stairs with concrete-filled treads.
2. Steel tube railings attached to metal stairs.
3. Steel tube handrails attached to walls adjacent to metal stairs.
4. Design calculations for the above.
5. Coordination of installation of Photo-luminescent stair tread and landing nosings and perimeter strips.

B. Related Sections:
1. Division 03 Section "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Division 05 Section "Pipe and Tube Railings" for pipe and tube railings not attached to metal stairs or to walls adjacent to metal stairs.
3. Division 06 Section "Miscellaneous Rough Carpentry" for wood blocking for anchoring railings.
4. Division 09 Section "Non-Structural Metal Framing" for metal backing for anchoring railings.
5. Division 10 Section "photoluminescent exit path markings" for stair and platform nosings and Handrail illumination strips.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

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. (4.79 kN/sq. m).
2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Seismic loads: As indicated on the Drawings.
5. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
6. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch (6.4 mm), whichever is less.

C. Structural Performance of Railings: Railings 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. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) 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 (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Infill load and other loads need not be assumed to act concurrently.

D. Seismic Performance: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Component Importance Factor is 1.5.

E. Photoluminescent Exit Path Markings: See Section 10 44 45 Photoluminescent Exit Path Markings.

1.3 ACTION SUBMITTALS

A. Product Data: For metal stairs and the following:
1. Paint products.
2. Grout.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Provide shop drawings sealed and signed by the same State of Maine Licensed Professional Engineer that prepared calculations.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

1.4 INFORMATIONAL SUBMITTALS

A. 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. Calculations: Submit design calculations prepared and sealed by a State of Maine Licensed Professional Engineer. Design stairs, landings, railings, their support framing, fasteners and anchors in accordance with the performance requirement loading criteria specified herein, code and other requirements. Submit calculations for the following:
a. Straight runs.
b. Platforms and landings.
c. anchorage

B. Qualification Data: For qualified manufacturer/fabricator and professional engineer.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide manufactured steel stairs by a firm producing the types of stair and railing systems required for not less than ten (10)

consecutive years, with not less than five (5) similar projects that have been in successful use for not less than five (5) years.

B. Installer Qualifications: Fabricator of products.

C. Installer Qualifications:
   1. Minimum five (5) consecutive years experience in the successful installation of steel stair and railing systems of the type indicated for this project.
   2. The Installer is to be acceptable to the Manufacturer of the stair system and the Architect. The Manufacturer is to provide written assurance to the Architect of the installer acceptability upon request.

D. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
   1. Preassembled Stairs: Commercial class.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

F. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 COORDINATION

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 metal stairs. 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. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 60 percent.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.

D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.

E. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30 (Grade 205), unless another grade is required by design loads.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

D. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

E. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).

F. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

G. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

H. Post-Installed Anchors: Torque-controlled expansion anchors or 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 E 488, conducted by a qualified independent testing agency.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.4 MISCELLANEOUS MATERIALS

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

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79, compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

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.

F. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa) unless otherwise indicated.

G. Welded Wire Fabric: ASTM A 185/A 185M, 6 by 6 inches (152 by 152 mm), W1.4 by W1.4, unless otherwise indicated.

H. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50 by 50 mm) by 0.062-inch- (1.6-mm-) diameter wire; comply with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
   1. Join components by welding unless otherwise indicated.
   2. Use connections that maintain structural value of joined pieces.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. 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. Weld exposed corners and seams continuously unless otherwise indicated.
   5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 STEEL-FRAMED STAIRS

A. Extending existing stairs: To the greatest extent possible, match existing metal stair materials and fabrication.

B. Stair Framing:
   1. Fabricate stringers of steel plates or channels or tubes, as indicated.
      a. Provide closures for exposed ends of channel and tube stringers.
   2. Construct platforms of steel plate, channel or tube headers and miscellaneous framing members as indicated.
   3. Weld stringers to headers; weld framing members to stringers and headers.
   4. Where stairs are enclosed by gypsum board, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
   5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.067 inch (1.7 mm).
   1. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
   2. Shape metal pans to include nosing integral with riser.
   3. At Contractor's option, provide stair assemblies with metal-pan subtreads filled with reinforced concrete during fabrication.
   4. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
      a. Smooth Soffit Construction: Construct exposed subplatforms with flat metal under surfaces to produce smooth soffits.

2.7 STAIR RAILINGS

A. Comply with applicable requirements in Division 05 Section "Pipe and Tube Railings."

2.8 FINISHES

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

B. Finish metal stairs after assembly.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with 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, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. 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.

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. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. 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.

F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

G. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-Place Concrete."
   1. Install photoluminescent nosings and perimeter strips with anchors fully embedded in concrete. Center nosings on tread width. See Section 19 44 45 “Photoluminescent Exit Path Markings.”

3.2 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
   1. Anchor posts to steel by welding directly to steel supporting members.

B. Attach handrails to wall with wall brackets. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements, as follows:
   1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   2. For hollow masonry anchorage, use toggle bolts.
   3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.

4. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
5. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
6. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.3 PHOTOLUMINESCENT EXIT PATH MARKINGS

A. See Section 10 44 45 Photoluminescent Exit Path Markings. Coordinate installation in accordance with Manufacturer's instructions.

3.4 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 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 (0.05-mm) dry film thickness.

END OF SECTION

SECTION 05 52 13

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel pipe and tube railings.
2. Steel mesh parking railings.
3. Design calculations for the above.

B. Related Sections:
1. Division 05 Section "Metal Stairs" for steel tube railings associated with metal stairs.
2. Division 05 Section "Decorative Metal Railings" for ornamental railings fabricated from pipes and tubes.
3. Division 06 Section "Miscellaneous Rough Carpentry" for wood blocking for anchoring railings.
4. Division 09 Section "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.2 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.
2. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
3. Stainless Steel: 60 percent of minimum yield strength.

C. Structural Performance: Railings 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. (0.73 kN/m) applied in any direction.
   b. Concentrated load of 200 lbf (0.89 kN) 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 (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
   b. Infill load and other loads need not be assumed to act concurrently.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

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. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Provide shop drawings sealed and signed by the same State of Maine Licensed Professional Engineer that prepared calculations.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For each type of exposed finish required.
1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
a. Show method of finishing and connecting members at intersections.

1.4 INFORMATIONAL SUBMITTALS

A. 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.

B. Calculations: Submit design calculations prepared and sealed by a State of Maine Licensed Professional Engineer. Design stairs, landings, railings, their support framing, fasteners and anchors in accordance with the performance requirement loading criteria specified herein, code and other requirements. Submit calculations for the following:
1. Handrails,
2. Guardrails,
3. Railings
4. Anchors.

C. Qualification Data: For qualified manufacturer/fabricator and professional engineer.

D. Welding certificates.

E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Manufacturer Qualifications: Provide manufactured railings by a firm producing the types of railing systems required for not less than ten (10) consecutive years, with not less than five (5) similar projects that have been in successful use for not less than five (5) years.

C. Installer Qualifications:
1. Minimum five (5) consecutive years experience in the successful installation of railing systems of the type indicated for this project.
2. The Installer is to be acceptable to the Manufacturer of the railing system and the Architect. The Manufacturer is to provide written assurance to the Architect of the installer acceptability upon request.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

E. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

F. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
1. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 600 mm (24 inches) in length.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PROJECT CONDITIONS

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

1.7 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.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.2 STEEL AND IRON

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 60 percent.

B. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

C. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
1. Provide galvanized finish for exterior installations and where indicated.

D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

E. Woven-Wire Mesh: Match existing square pattern, and wire size, woven-wire mesh, made from wire complying with ASTM A 510 (ASTM A 510M).

F. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 FASTENERS

A. General: Provide the following:
1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 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 withstanding design loads.

C. Fasteners for Interconnecting Railing Components:
1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
3. Provide square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or 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 E 488, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.4 MISCELLANEOUS MATERIALS

A. Flanges for flange attached, removable railings: Kee Klamp pipe fitting; Type 62 Standard Railing Flange.

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

C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 compatible with paints specified to be used over it.

E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

F. Shop Primer for Galvanized Steel: Water based galvanized metal primer complying with MPI#134.

G. 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.

2.5 FABRICATION

A. Extending Existing Stairs: To the greatest extent possible, match existing pipe and tube railings materials and fabrication.

B. Parking Railings: To the greatest extent possible, match existing steel parking railings materials and fabrication.

C. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

D. 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.

E. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

F. Form work true to line and level with accurate angles and surfaces.

G. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

I. Connections: Fabricate railings with welded connections unless otherwise indicated.

J. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove flux immediately.
   4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

K. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
   1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

L. Form changes in direction as follows:
   1. By inserting prefabricated elbow fittings.

M. Close exposed ends of railing members with prefabricated end fittings.

N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
   1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

Q. For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

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

S. For removable railing posts, where indicated, install into railing flanges anchored to concrete floor.
   1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

T. 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.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products"

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 the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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

D. Galvanize exterior railings.

E. Prime interior railings for field painting.

2.7 STEEL AND IRON FINISHES

A. Galvanized Railings:
   1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
   2. Hot-dip galvanize indicated steel and iron railings, including hardware, after fabrication.
   3. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
   4. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
   5. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
   6. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

F. Primer Application: Apply shop primer to prepared surfaces of railings 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. Primer need not be applied to surfaces to be embedded in concrete or masonry.
   1. Shop prime uncoated railings with universal shop primer unless otherwise indicated.

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 (2 mm in 1 m).
   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 (5 mm in 3 m).

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. 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. 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.

B. 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 (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) 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 or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Anchor posts to concrete: Clean sleeves of loose material, insert posts, and fill annular space between post and sleeves with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
   1. Leave anchorage joint exposed with 1/8-inch (3-mm) buildup, sloped away from post.

C. Anchor posts to metal surfaces by welding as required by conditions, connected to posts and to metal supporting members as follows:
   1. For steel pipe railings, fix flanges to post with set screws, and bolt to metal supporting surfaces.
   2. For steel pipe railings, fix flanges to post with set screws, and anchor to concrete supporting surfaces, with post-installed anchors.

D. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

E. Anchoring parking railings: Anchor to precast concrete spandrels to match existing construction.

3.5 ATTACHING RAILINGS

A. Attach railings to wall with wall brackets. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
   1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
   2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets and railing end flanges to building construction as follows:
   1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   2. For hollow masonry anchorage, use toggle bolts.
   3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
   4. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
   5. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

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 the 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 (0.05-mm) dry film thickness.

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.

END OF SECTION

SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rooftop equipment bases and support curbs.
2. Wood blocking and nailers.
3. Wood furring.
4. Wood sleepers.
5. Plywood backing panels.

B. Related Requirements:
1. Section 06 16 00 "Sheathing" for sheathing, subflooring, and underlayment.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater size but less than 5 inches nominal (114 mm actual) size in least dimension.

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 materials comply 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 materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:
1. Preservative-treated wood.

2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

1.5 QUALITY ASSURANCE

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

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.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Certified Wood: Lumber and plywood shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001 and FSC STD-40-004.

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Dress lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

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

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

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

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat items indicated on Drawings, and the following:
1. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
2. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
3. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
4. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply 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 Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, 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 (3.2 m) beyond the centerline of the burners at any time during the test.
1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings, and the following:
   1. Framing for raised platforms.
   2. Concealed blocking.
   3. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

A. Other Framing: Construction or No. 2 grade of any species:

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Rooftop equipment bases and support curbs.
   4. Cants.
   5. Furring.
   6. Grounds.
   7. Utility shelving.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:
   1. Eastern softwoods, No. 2 Common grade; NELMA.
   2. Northern species, No. 2 Common grade; NLGA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Screws for Fastening to Metal Framing: ASTM C 1002 or ASTM C 954, length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
   2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.8 METAL FRAMING ANCHORS

A. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
   1. Use for interior locations unless otherwise indicated.

B. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
   1. Use for wood-preservative-treated lumber and where indicated.

2.9 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
   1. 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."

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
   2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal (38-mm actual) thickness.
   3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
   4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.

H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with

defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
   2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
   3. ICC-ES evaluation report for fastener.

L. Use steel common 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 between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or 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.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring vertically at 16 inches (406 mm) o.c.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 06 16 00

SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Wall sheathing.
2. Parapet sheathing.

B. Related Requirements:
1. Section 06 10 53 "Miscellaneous Rough Carpentry" for plywood backing panels.
2. Section 07 25 00 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.2 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 according to ASTM D 5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:
1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Foam-plastic sheathing.

1.4 QUALITY ASSURANCE

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

1.5 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 according to ASTM E 119; 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 WOOD PANEL PRODUCTS

A. Emissions: Products shall 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."

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

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

2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete.

2.4 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 according to ASTM E 84, 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 (3.2 m) 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 shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201/D 3201M at 92 percent relative humidity. Use where exterior type is not indicated.

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.

2.5 WALL SHEATHING

A. Plywood Sheathing: , Exterior, Structural I sheathing.
   1. Span Rating: Not less than 24/0.
   2. Nominal Thickness: Not less than 1/2 inch (13 mm).

B. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
   1. Type and Thickness: Regular, 1/2 inch (13 mm) and Type X, 5/8 inch (15.9 mm) thick, where indicated, or required for fire-resistant construction.

2.6 PARAPET SHEATHING

A. Plywood Sheathing: , Exterior, Structural I sheathing.
   1. Span Rating: Not less than 24/0.
   2. Nominal Thickness: Not less than 1/2 inch (13 mm).

B. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
   1. Type and Thickness: Regular, 1/2 inch (13 mm) unless Type X, 5/8 inch (15.9 mm) thick is indicated.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. For parapet and wall sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

B. Nails, Brads, and Staples: ASTM F 1667.

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 C 1002.

E. Screws for Fastening Wood Structural Panels 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. 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 (0.835 mm) thick, use screws that comply with ASTM C 1002.
   2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C 954.

2.8 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
   1. 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 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. Coordinate wall and parapet 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.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. 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 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:
1. Wall and Parapet Sheathing:
   a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
   b. Screw to cold-formed metal framing.
   c. Space panels 1/8 inch (3 mm) apart at edges and ends.

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
1. Fasten gypsum sheathing to wood framing with [**nails**] [**or**] [**screws**].
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install panels with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
4. Install panels with a 1/4-inch (6.4-mm) 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 (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) 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 (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) 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.

END OF SECTION

SECTION 07 18 00

TRAFFIC COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes traffic coatings and pavement markings for the following applications:
   1. Vehicular traffic.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include installation instructions and details, material descriptions, dry or wet film thickness requirements, and finish.

B. Shop Drawings: For traffic coatings.
   1. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions that are not included in manufacturer's product data.
   2. Include plans showing layout of pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

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

D. Samples for Verification: For each type of exposed finish, prepared on rigid backing.
   1. Provide stepped Samples on backing to illustrate buildup of traffic coatings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of traffic coating.

C. Field quality-control reports.

D. Sample Warranty: For manufacturer's warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For traffic coatings to include in maintenance manuals.

1.6 QUALITY ASSURANCE

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

B. Mockups: Build mockups to set quality standards for materials and execution.
   1. Build mockup for each traffic coating and substrate to receive traffic coatings.
   2. Size: 200 sq. ft. (18.5 sq. m) of each substrate to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship.
   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 FIELD CONDITIONS

A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F (5 deg C), when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.
   1. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of substrate.

B. Do not install traffic coating until items that penetrate membrane have been installed.

C. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace traffic coating that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Adhesive or cohesive failures.
      b. Abrasion or tearing failures.
      c. Surface crazing or spalling.
      d. Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations:

1. Obtain traffic coatings from single source from single manufacturer.
2. Obtain primary traffic-coating materials, including primers, from traffic-coating manufacturer. Obtain accessory materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of types and from sources recommended in writing by primary material manufacturer.
3. Obtain pavement-marking paint from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Material Compatibility: Provide primers; base coat, intermediate coat, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.3 TRAFFIC COATING TC-2

A. Apply coating to suspended slabs and toppings.

B. Basis of Design: Subject to compliance with the requirements, provide Tremco; Vulkem 350NF/950NF/951NF, traffic-bearing, seamless, high-solids-content, cold liquid-applied, elastomeric, water-resistant membrane system with integral wearing surface for vehicular traffic; according to ASTM C 957/C 957M, or a comparable product, one of the following.
1. BASF, MasterSeal® Traffic 2000 (Low VOC).
2. Tremco Incorporated,
3. Stonhard, STONGARD® TM

C. Preparatory and Base Coats: Single component Polyurethane.
1. Thicknesses: Minimum dry- or wet- film thickness as recommended in writing by manufacturer for substrate and service conditions indicated.
2. Minimum thickness: 25 wet mils.

D. Intermediate Coat: Two component Polyurethane.
1. Thicknesses: Minimum dry- or wet- film thickness as recommended in writing by manufacturer for substrate and service conditions indicated, measured excluding aggregate.
2. Aggregate Content: As recommended in writing by traffic-coating manufacturer for substrate and service conditions indicated.
3. Minimum thickness: 12 wet mils.
4. Apply 2 coats at turning and other high wear areas.

E. Topcoat: Two component Aliphatic urethane.
1. Thicknesses: Minimum dry- or wet- film thickness as recommended in writing by manufacturer for substrate and service conditions indicated, measured excluding aggregate.
2. Minimum thickness: 12 wet mils.
3. Color: As selected by Architect from manufacturer's full range.

F. Aggregate: Manufacturer's standard aggregate for each use indicated of particle sizes, shape, and minimum hardness recommended in writing by traffic-coating manufacturer.

G. Fire-Test-Response Characteristics: Provide traffic-coating materials with the fire-test-response characteristics as determined by testing identical products according to test method below for deck type and slopes indicated by an independent testing and inspecting agency that is acceptable to authorities having jurisdiction.
1. Class A roof covering according to ASTM E 108.

H. VOC Content: 100 g/L or less.

I. Low-Emitting Materials: Interior coatings 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."

2.4 ACCESSORY MATERIALS

A. Joint Sealants: Manufacturer's standard product for use with the specified system, ASTM C 920.

B. Sheet Flashing: Nonstaining sheet material recommended in writing by traffic-coating manufacturer.
1. Thickness: As recommended by the manufacturer, but no less than, 50 mils (1.3 mm).

C. Adhesive: Contact adhesive recommended in writing by traffic-coating manufacturer.

D. Reinforcing Strip: Fiberglass mesh recommended in writing by traffic-coating manufacturer.

2.5 TRAFFIC DECK COATING TC-3

A. Apply coating for parking slabs on grade.

B. General: Hydrophobic, non-film forming, non-coloring, penetrating siloxane or silane sealer complying with the following requirements:

PROPERTY	TEST RESULTS	TEST METHOD
Percent Water Absorption Reduction	85 % minimum	NCHRP No. 244 Series II
Percent Chloride Ion Intrusion Reduction	84 % minimum	NCHRP No. 244 Series II
Freeze/Thaw Scaling Resistance	No scaling	ASTM C672 (C672M) Minimum 50 cycles
Depth of Penetration	0.24 in. (6mm) Series II	NCHRP No. 244

C. Acceptable Manufacturers: Provide one of the following:
1. "Enviroseal 40" (Hydrozo, Inc. div. degussa).

2. "Aqua-Trete BSM 40" (Sivento Silanes, Inc. div degussa).
3. "Stifel SC" (Nox-Crete, Inc.).

2.6 PAVEMENT MARKINGS

A. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.
1. Colors: As selected by the Architect.

B. VOC Content: 100 g/L or less.

C. Low-Emitting Materials: Interior paints 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, with Installer present, for compliance with requirements for maximum moisture content, surface smoothness, and other conditions affecting performance of traffic-coating work.

B. Verify that substrates are visibly dry and free of moisture.
1. Test for moisture according to ASTM D 4263.
2. Test for moisture content by method recommended in writing by traffic-coating manufacturer.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of traffic-coating work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Begin coating application only after substrate construction and penetrating work have been completed.
2. Begin coating application only after minimum concrete-curing and -drying period recommended in writing by traffic-coating manufacturer has passed and after substrates are dry.
3. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Clean and prepare substrates according to ASTM C 1127 and manufacturer's written instructions to produce clean, dust-free, dry substrate for traffic-coating application. Remove projections, fill voids, and seal joints if any, as recommended in writing by traffic-coating manufacturer.

B. Priming: Unless manufacturer recommends in writing against priming, prime substrates according to manufacturer's written instructions.
1. Limit priming to areas that will be covered by traffic-coating material on same day. Reprime areas exposed for more time than recommended by manufacturer.

C. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.

D. Mask adjoining surfaces not receiving traffic coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent traffic-coating materials from entering deck substrate penetrations and clogging weep holes and drains.

E. Concrete Substrates: Mechanically abrade surface to a uniform profile acceptable to manufacturer, according to ASTM D 4259. Do not acid etch.
   1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
   2. Remove concrete fins, ridges, and other projections.
   3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
   4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D 4258.

3.3 TERMINATIONS AND PENETRATIONS

A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C 1127 and manufacturer's written instructions.

B. Provide sealant cants at penetrations and at reinforced and nonreinforced, deck-to-wall butt joints.

C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.

D. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.

3.4 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C 1127 and manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.
   1. Comply with recommendations in ASTM C 1193 for joint-sealant installation.

B. Apply reinforcing strip in traffic-coating system where recommended in writing by traffic-coating manufacturer.

3.5 TRAFFIC-COATING APPLICATION

A. Apply traffic coating according to ASTM C 1127 and manufacturer's written instructions.

B. Apply coats of specified compositions for each type of traffic coating at locations as indicated on Drawings.

C. Start traffic-coating application in presence of manufacturer's technical representative.

D. Verify that wet-film thickness of each coat complies with requirements every 100 sq. ft. (9 sq. m).

E. Uniformly broadcast and embed aggregate in each coat indicated to receive aggregate according to manufacturer's written instructions. After coat dries, sweep away excess aggregate.

F. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated; omit aggregate on vertical surfaces.

G. Cure traffic coatings. Prevent contamination and damage during coating application and curing.

3.6 PAVEMENT MARKINGS

A. Do not apply pavement-marking paint for striping and other markings until layout, colors, and placement have been verified with Architect and traffic coating has cured.

B. Sweep and clean surface to eliminate loose material and dust.

C. Apply pavement-marking paint with mechanical equipment to produce markings of dimensions indicated with uniform straight edges. Apply at manufacturer's recommended rates for a minimum wet-film thickness of 15-mils (0.4-mm).
   1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
   2. Broadcast glass beads uniformly into wet pavement-marking paint at a rate of 6 lb/gal. (0.72 kg/L).

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform the following field tests and inspections:
   1. Materials Testing:
      a. Samples of material delivered to Project site shall be taken, identified, sealed, and certified in presence of the Contractor.
      b. Testing agency shall perform tests for characteristics specified, using applicable referenced testing procedures.
      c. Testing agency shall verify thickness of coatings during traffic-coating application for each 600 sq. ft. (56 sq. m) of installed traffic coating or part thereof.

B. Final Traffic-Coating Inspection: Arrange for traffic-coating manufacturer's technical personnel to inspect membrane installation on completion.
   1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

C. Traffic coating will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 PROTECTING AND CLEANING

A. Protect traffic coatings from damage and wear during remainder of construction period.

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

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Mineral-wool blanket insulation.
2. Vapor retarders.

B. This Section includes the following insulation uses:
1. Concealed building insulation.

C. Related Sections include the following:
1. Division 07 Section "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.

1.2 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.3 SUBMITTALS

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

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

C. Research/Evaluation Reports: For foam-plastic insulation, and thermal barrier, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
1. Surface-Burning Characteristics: ASTM E 84.
2. Combustion Characteristics: ASTM E 136.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by 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.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not install insulation during inclement weather or when surfaces are moist.

B. Do not install batt insulation in exterior wall assemblies until exterior sheathing has been installed and joints sealed in accordance with Division 07 Section "Sheathing", and air barrier has been fully applied to exterior face of sheathing in accordance with applicable Division 07 Section.
   1. Insulation that is exposed to moisture due to inadequate or compromised environmental protections, or that becomes wet or moist by other means subsequent to installation, shall be completely removed and discarded, and replaced with new materials.

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. Basis of Design Products: Provide the specified or indicated product or a comparable product by one of the other named manufacturers.
   2. Products: Subject to compliance with requirements, provide one of the products specified.
   3. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PERFORMANCE REQUIREMENTS

A. Plenum Rating: Provide slag-wool-fiber/rock-wool-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
   1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm (13-m/s) air velocity.
   2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

B. Recycled Content:

1. Provide slag-wool-fiber/rock-wool-fiber insulation with recycled content so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

C. Formaldehyde Free: Provide formaldehyde-free products, or low emitting products.

2.3 MINERAL-WOOL BLANKET INSULATION

A. Basis of Design Manufacturer: Subject to compliance with requirements, provide Mineral-Wool Blanket Insulation products by Roxul, or comparable products by one of the following:
1. Fibrex Insulations Inc.
2. Owens Corning.
3. Roxul Inc.
4. Thermafiber.

B. Unfaced, Mineral-Wool Blanket Insulation [**INS-3A**]: Specifically produced to provide fire containment between floors utilizing mineral fibers combined with thermosetting resins; complying with 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. Density: 4.5 lbs/ft³ (72 kg/m³) minimum.
2. Thickness: As scheduled.
3. Acceptable Products:
   a. Roxul Safe.

C. Reinforced-Foil-Faced, Mineral-Wool Blanket Insulation [**INS-3B**]: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less per ASTM E 84); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

2.4 VAPOR RETARDERS

A. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders [**VR-2**]: Two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim and weighing not less than 22 lb/1000 sq. ft. (10 kg/100 sq. m), with maximum permeance rating of 0.1317 perm (7.56 ng/Pa x s x sq. m) and with flame-spread and smoke-developed indexes of not more than 5 and 60, respectively, per ASTM E 84.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Raven Industries Inc.; DURA-SKRIM 2FR.
   b. Reef Industries, Inc.; Griffolyn T-55 FR.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

D. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

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

3.2 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool 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. 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.

3.5 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs.
   1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (406 mm) o.c.
   2. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
   3. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.6 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.

3.7 INSULATION SCHEDULE

A. Insulation Type INS-3A: Un-faced, slag-wool-fiber/rock-wool-fiber blanket insulation.
   1. Framed assemblies with separate vapor retarder.

B. Insulation Type INS-3B: Faced, slag-wool-fiber/rock-wool-fiber blanket insulation.
   1. Framed assemblies.

END OF SECTION

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SECTION 07 27 20

AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Fluid-applied membrane air barrier, vapor retarding.
2. Fluid-applied membrane air barrier, vapor permeable.
3. Self-adhering, vapor-retarding, sheet air barriers.
4. Self-adhering, sheet air barriers, vapor permeable.

B. Related Sections include the following:
1. Division 01 Section "Allowances" for testing and inspecting allowances.
2. Division 06 Section "Sheathing" for wall sheathing.
3. Division 07 low-slope roofing Sections for roof air barriers.
4. Division 07 Section "Thermal Insulation" for foam-plastic board insulation.
5. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashings.
6. Division 07 Section "Joint Sealants" for joint-sealant materials and installation.

1.2 DEFINITIONS

A. ABAA: Air Barrier Association of America.

B. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall. The intent of this combined section is to allow the contractor some flexibility in the location of the fluid-applied membrane air barrier and self-adhering, vapor-retarding, modified bituminous sheet air barriers used.

1.3 PERFORMANCE REQUIREMENTS

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

B. Air Barrier Assembly Air Leakage: Not to exceed 0.04 cfm x sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa); ASTM E 2357.

C. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly, consistent with the building construction as designed.

1.4 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to air barrier manufacturers, for testing indicated below, samples of materials that will contact or affect air barriers and air barrier sealants.
   1. Submit not fewer than eight pieces of each kind of material, including substrates, shims, backings, sealants and miscellaneous materials.
   2. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   3. For materials failing tests, obtain air barriert manufacturer's written instructions for corrective measures including use of specially formulated primers.
   4. Testing will not be required if air barrier manufacturers submit data that are based on previous testing, not older than 24 months, of products for adhesion to, and compatibility with, substrates and other materials matching those submitted.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Show locations and extent of air barriers. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   1. Include details of interfaces with other materials that form part of air barrier.
   2. Indicate each condition, product, and sequence of installation recommended by membrane manufacturer.
   3. Include details of mockups.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.

B. Qualification Data: For Applicator. Provide letter from membrane manufacturer indicating applicator is trained and approved by manufacturer.

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

1.7 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance and that is trained and authorized by membrane manufacturerand that is an ABAA-licensed contractor, employs certified and registered installers, and complies with ABAA's Quality Assurance Program.

B. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assembly incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
   1. See Section 01 45 34 "Mockups For Exterior Wall Systems."

C. Laboratory testing shall be performed on mockups according to requirements in Specification Section 01 45 36 "Performance Testing for Exterior Wall and Window Systems."
   1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

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

1.8 DELIVERY, STORAGE, AND HANDLING

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

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

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

D. Protect stored materials from direct sunlight.

1.9 WARRANTY

A. Material Warranty: Provide the manufacturer's 5 year air barrier material warranty.

1.10 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain all air barriers from a single source from single manufacturer.
   1. Obtain accessory materials from the same manufacturer, or from manufacturers approved in writing by the Air Barrier manufacturer.

2.2 FLUID-APPLIED MEMBRANE AIR BARRIERS

A. [**AB-1**] Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Elastomeric, modified bituminous or synthetic polymer membrane.
   1. Basis of Design: Grace, W. R. & Co.; Perm-A-Barrier NPL 10/NPL 10 LT.
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. Synthetic Polymer Membrane:
         1) GCP Applied Technologies Inc.; Perm-A-Barrier® NPL 10/NPL 10 LT
         2) Henry Company; Air-Bloc 21FR (fire-rated 32 (waterborne).
   3. Physical and Performance Properties:
      a. Membrane Air Permeance: Not to exceed 0.004 cfm x sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
      b. Membrane Vapor Permeance: Not to exceed 1 perm; ASTM E 96.
      c. Adhesion to Substrate: Minimum 16 lbf/sq. in. (110 kPa) when tested according to ASTM D 4541.
      d. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
      e. UV Exposure: Can be exposed to sunlight for 2 months in typical conditions, 1 month in severe exposure.

B. [**AB-2**] Fluid-Applied, Vapor-Permeable Membrane Air Barrier: synthetic polymer membrane.
   1. Basis of Design: GCP Applied Technologies Inc.; Perm-A-Barrier VPL.
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. GCP Applied Technologies Inc.; Perm-A-Barrier VPL.
      b. Henry Company; Air-Bloc 33.
   3. Physical and Performance Properties:
      a. Membrane Air Permeance: Not to exceed 0.004 cfm/ sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
      b. Membrane Vapor Permeance: Not less than 10 perms Insert value; ASTM E 96.
      c. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
      d. UV Resistance: Can be exposed to sunlight for 6 months

2.3 SELF-ADHERING SHEET AIR BARRIERS

A. [**AB-1A**] Vapor-Retarding Nonbituminous Sheet (Non-Permeable Air Barrier): 18-mil- thick, self-adhering sheet with release liner on adhesive side and formulated

for application without primer and with primer that complies with VOC limits of authorities having jurisdiction and project VOC requirements.

1. Basis of Design: GCP Applied Technologies Inc.; Perm-A-Barrier NPS Wall Membranes.
2. Products: Subject to compliance with requirements, provide one of the following:
   a. GCP Applied Technologies Inc.; Perm-A-Barrier® NPS Wall Membranes.
   b. Henry Company; Blueskin SA.
3. Physical and Performance Properties:
   a. Membrane Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
   b. Tensile Strength: 400 psi minimum; ASTM D 412.
   c. Ultimate Elongation: 200 percent minimum; ASTM D 412, Die C, modified.
   d. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
   e. Crack Cycling: 1/8-inch movement; ASTM C1305, Pass.
   f. Puncture Resistance: 40 lbf minimum; ASTM E 154.
   g. Water Absorption: 0.1 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
   h. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.
   i. Adhesion to Substrate: Minimum 5 lbf/sq. in. when tested according to ASTM D 903.
   j. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
   k. UV Resistance: Can be exposed to sunlight for one year

B. [**AB-2A**] Vapor-Permeable Nonbituminous Sheet: Minimum 20-mil- (0.5-mm-) thick, self-adhering sheet consisting of a breathable carrier film or fabric and an adhesive with release liner on adhesive side and formulated for application with primer that complies with VOC limits.
   1. Basis of Design: Grace, W. R. & Co.; Perm-A-Barrier VPS.
   2. Products: Subject to compliance with requirements, provide products by the following:
      a. GCP Applied Technologies Inc.; Perm-A-Barrier.
      b. Henry Company; Blueskin, VP 160.
   3. Physical and Performance Properties:
      a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
      b. Puncture Resistance: Minimum 40 lbf (180 N); ASTM E 154/E 154M.
      c. Vapor Permeance: Minimum 15 perms (860 ng/Pa x s x sq. m); ASTM E 96/E 96M, Desiccant Method, Procedure A.
      d. Adhesion to Substrate: Minimum 16 lbf/sq. in. (110 kPa) when tested according to ASTM D 4541 as modified by ABAA.
      e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
      f. UV Resistance: Can be exposed to sunlight for 150 days.

2.4 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall

comply with VOC limits of authorities having jurisdiction and project VOC requirements.

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

C. Counterflashing Strip: Modified bituminous, 40-mil- (1.0-mm-) thick, self-adhering sheet consisting of 32 mils (0.8 mm) of rubberized asphalt laminated to an 8-mil- (0.2-mm-) thick, crosslaminated polyethylene film with release liner backing.

D. Modified Bituminous Transition Strip: Vapor-retarding, 40-mil- (1.0-mm-) thick, smooth-surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick polyethylene film with release liner backing.

E. Modified Bituminous Transition Strip for long exposure: Vapor-retarding, 25-mil-thick, smooth-surfaced, self-adhering; consisting of rubberized asphalt laminated to aluminum surfaced, cross-laminated HDPE with release liner backing.

F. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Dow Corning Corporation; 123 Silicone Seal.
      b. Momentive Performance Materials Inc.; US11000 UltraSpan.
      c. Pecora Corporation; Sil-Span.
      d. Tremco Incorporated, an RPM company; Spectrem Simple Seal.

G. Termination Mastic: Cold fluid-applied elastomeric liquid; trowel grade.

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

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

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

K. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch (0.5 mm) thick, and Series 300 stainless-steel fasteners.

L. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft (24 to 32 kg/cu. m) density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

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

N. Joint Sealant: Single- or multi-component, moisture curing, low-modulus, high-movement polyether joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated, and complying with the following:
   1. Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates:
      a. Type and Grade: M (multicomponent) and NS (nonsag).
      b. Class: 100/50.
      c. Uses Related to Exposure: NT (nontraffic).
      d. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
   2. Basis of Design Products: Provide one of the following:
      a. Sonneborn, Division of ChemRex Inc.; Sonolastic 150 Polyether Sealant.
      b. STS Coatings, Inc., GreatSeal PE-150 Polyether Sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
   3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   4. Verify that masonry joints are flush and completely filled with mortar.
   5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

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

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

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

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

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

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

1. Install modified bituminous strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch (1.6 mm).

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

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

3.3 JOINT TREATMENTS (FLUID APPLIED MEMBRANE)

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
1. Prime substrate and apply a double thickness of modified bituminous transition strip, with the 3 inch wide first laver applied with adhesive against 6 inch wide second layer.

B. Gypsum Sheathing: Fill joints greater than 1/4 inch (6 mm) with sealant according to ASTM C 1193 and with air barrier manufacturer's written instructions. Apply first layer of fluid air barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air barrier membrane over joint reinforcing strip.

3.4 INSTALLATION, GENERAL (FLUID APPLIED MEMBRANE)

A. Install fluid-applied membrane air barrier system in accordance with manufacturer’s instructions and as specified here in.

3.5 TRANSITION STRIP INSTALLATION (FLUID APPLIED MEMBRANE)

A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates.

B. For transition strips that will be exposed longer than 30 days, use aluminum surfaced transition strips.

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

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

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

F. 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.

G. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply preformed silicone-sealant extrusion so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.
   1. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.

H. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

I. Seal top of through-wall flashings to air barrier with termination bar and sealant.

J. Seal ~~exposed~~ edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic as required by membrane manufacturer.

K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.6 AIR BARRIER MEMBRANE INSTALLATION (FLUID APPLIED MEMBRANE)

A. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.

B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.

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

D. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.
   1. Vapor-Retarding Membrane Air Barrier: 60-mil (1.5-mm) dry film thickness.

E. Apply strip and transition strip a minimum of 1 inch (25 mm) onto cured air membrane or strip and transition strip over cured air membrane overlapping 3 inches (75 mm) onto each surface according to air barrier manufacturer's written instructions.

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

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

3.7 AIR BARRIER MEMBRANE INSTALLATION (SHEET MEMBRANES)

A. Install modified bituminous sheets according to air barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.
   1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous air barrier sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).

B. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
   1. Install modified bituminous strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of termination mastic on horizontal inside corners.

C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.

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

E. Apply and firmly adhere modified bituminous sheets horizontally over area to receive air barrier sheets. Accurately align sheets and maintain a uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure airtight installation.
   1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
   2. Roll sheets firmly to enhance adhesion to substrate.

F. Apply continuous modified bituminous sheets over modified bituminous strips bridging substrate cracks, construction, and contraction joints.

G. CMU: Install air barrier sheet horizontally against the CMU beginning at base of wall. Align top edge of air barrier sheet immediately below protruding masonry ties or joint reinforcement or ties and firmly adhere in place.
   1. Overlap horizontally adjacent sheets a minimum of 2 inches (50 mm) and roll seams.
   2. Apply overlapping sheets with bottom edge slit to fit around masonry reinforcing or ties. Roll firmly into place.
   3. Seal around masonry reinforcing or ties and penetrations with termination mastic.
   4. Continue the membrane into all openings in the wall, such as doors, windows, and terminate at points to maintain an airtight barrier that will not be visible from interior.

H. Seal top of through-wall flashings to air barrier with termination bar and sealant.

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

I. Install air barrier sheets and auxiliary materials to form a seal with adjacent construction and to maintain a continuous air barrier.
   1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
   2. Install modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates.

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

K. Wall Openings: Prime concealed perimeter and extend transition strips at perimeter of opening to interior as indicated.

L. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

M. At end or each working day, seal top edge of membrane to substrate with termination mastic.

N. 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.

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

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

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

3.8 FIELD QUALITY CONTROL

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

B. See Section 01 45 36 "Performance Testing for Exterior Wall Systems" for field quality control testing.

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

D. Air barriers will be considered defective if they do not pass inspections.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

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

F. Prepare test and inspection reports.

3.9 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. When covering membrane, use covering approved by the membrane manufacturer. Remove and replace air barrier exposed for more than 90 days, or exposure period stated in Manufacturer’s instructions if less than 90 days.
   2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.

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

C. Remove masking materials after installation.

END OF SECTION

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SECTION 07 46 46

FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fiber-cement siding.

B. Related Requirements:
1. Section 06 10 00 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
2. Section 05 40 00 “Cold Formed Metal Furring” for furring.

1.2 COORDINATION

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

1.3 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 Verification: For each type, color, texture, and pattern required.
1. 12-inch- (300-mm-) long-by-12 inch-width Sample of siding.
2. 12-inch- (300-mm-) long-by-actual-width Samples of trim and accessories.

1.4 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.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.6 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 mockup of typical wall area as shown on Drawings.
   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.

1.7 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.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including cracking and deforming.
      b. Deterioration of materials beyond normal weathering.
   2. Warranty Period: 30 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Alura.
      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 (8 mm).

D. Panel Texture: 48-inch- (1200-mm-) wide sheets with smooth texture.

E. Factory Painting: Manufacturer's standard acrylic solid color finish.
1. Color: As selected from full range of manufacturer’s standard and premium colors.

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. Flashing: Provide stainless-steel flashing complying with Section 07 62 00 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.
1. Thickness: 0.19 inches minimum.

C. Fasteners:
1. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch (6 mm), or three screw-threads, into substrate.
2. For fastening fiber cement, use stainless-steel fasteners, color matched to the panels.

D. Insect Screening for Vents: Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

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

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
1. Do not install damaged components.
2. Install fasteners no more than 16 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

SECTION 07 54 23

THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Adhered TPO membrane roofing system.
2. Roof insulation.
3. Cover boards.
4. Walkway products.

B. Related Sections:
1. Section 06 10 53 "Miscellaneous Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
3. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
4. Section 22 14 23 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

A. TPO: Thermoplastic polyolefin.

B. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane 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. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. FM Global Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system, and that are listed in FMG's "Approvals Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
1. Fire/Windstorm Classification: Class 1A- 105, for the Stair Tower, with enhancements as follows:

2. Completed Work shall withstand the design wind pressure, as follows:

	Roof Area	Field (psf)	Perimeter (psf)	Corners (psf)
a.	Stair Tower	105	150	210

3. Hail Resistance: SH.

D. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
1. Outline of each roof or roof area, number for reference, showing the location and type of all penetrations, location of and type of seams and keyed locations for all details, height and dimensions of each labeled roof area, and the dimensions and locations of all perimeter and corner areas.
2. Base flashings and membrane terminations.
   a. Indicate complete installation details of roofing and flashing, including roof slopes, flashing details, penetration details and accessories.
   b. Furnish project-specific details; manufacturer's standard pre-printed details will not be acceptable Shop Drawings.
3. Substrate slopes.
4. Tapered insulation, including slopes.
5. Drain sumps, including slopes.
6. Insulation Crickets, Saddles and Tapered System: Shop drawings showing layout, dimensions, slopes, details and method of attachment to substrate.
7. Insulation fastening patterns for corner, perimeter, and field-of-roof locations necessary to satisfy windstorm classification rating specified.
8. Perimeter and penetration details, including methods of attachment, additional membrane securement bars and strips, splices, sizes, spacing and types of all anchors and fasteners.
9. Walkways: Shop drawings of each roof or roof area showing the layout and pattern of walkways.
10. Show all roof mounted equipment, projections and penetrations thru the pavers.

C. Samples for Verification: For the following products:
1. Sheet roofing, of color specified, including T-shaped side and end lap seam, 12-by-12-inch(300-by-300-mm) square .
2. Roof insulation, 12-by-12-inch(300-by-300-mm) square.
3. Metal termination bars, 12 inch long.
4. Six insulation fasteners of each type, length, and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

B. Qualification Data: For qualified Installer and manufacturer to demonstrate their capabilities and experience. Include lists of completed projects with project names

and addresses, names and addresses of architects and owners, and other information specified.

C. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
   1. Submit evidence of compliance with performance requirements.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

E. FM Global Form 2688, Checklist for Roofing System, for each new roof assembly. The Form 2688 should include a RoofNav Assembly number and contain all the materials utilized in the roofing project. Exact trade names of the materials being utilized should be stated along with the proposed fastening rates and insulation thicknesses.

F. Roof manufacturer’s assembly letter.

G. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES

H. Field quality-control reports.

I. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.
   1. Field Seams: After installation is completed, submit 2 copies of inspection and testing report prepared by the single ply membrane manufacturer and countersigned by the applicator, outlining the testing and inspection procedures and attesting to the fact that the single ply membrane field seams including the expansion joints, were 100% inspected and tested.
   2. Fastener Pull-Out Tests: After installation is completed, submit 2 copies of test report, outlining test procedures, test results and remedial actions taken, if required.
   3. Water Tests: After installation is completed, submit 2 copies of test report, outlining test procedures, test results and remedial actions taken, if required.
   4. Thermal Immagry: Perform thermal imaging study and report according to ASTM C-1153 "Location of Wet Insulation in Roofing Systems Using Infrared Imaging."

B. Manufacturer's Acceptance Certification: Upon completion of the Work submit a written certified statement signed by the manufacturer stating that the field supervision by the manufacturer's representative was sufficient to insure proper application of the materials, that the Work was installed in accordance with the Contract Documents and that the installation is acceptable to the manufacturer and in compliance with specified warranty requirements.

C. Maintenance Manuals: For roofing system to include in the maintenance manuals, submit two (2) sets of manufacturer's printed instructions and recommendations for proper maintenance of the specified roof system including inspection

frequencies, penetration addition policies, temporary repairs, and leak call procedures.

D. Warranty: Copy of executed warranty stating obligations, remedies, limitations, and exclusions of warranty.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.

B. Installer Qualifications: Engage an experienced installer, with 5 years successful experience on projects of comparable size and scope to this Project, to perform work of this Section and who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

C. Source Limitations: Obtain components including roof insulation fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

E. Reference Standards: Comply with the applicable provisions of the referenced standards except as modified by governing codes and the Contract Documents.
   1. Single Ply Roofing Institute (SPRI):
      a. Wind Load Design Guide For Low Sloped Flexible Membrane Roofing Systems
      b. Fastener Selection Guide
      c. ANSI/SPRI FX-1 Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
      d. ANSI/SPRI ES-1 Wind Design Guide For Edge Systems Used With Low Slope Roofing Systems
   2. National Roofing Contractor's Association (NRCA): Roofing and Waterproofing Manual.
   3. American Society of Civil Engineers (ASCE): ASCE-7 Minimum Design Loads for Buildings and Other Structures.
   4. Factory Mutual Group (FMG)
      a. FMG 4450: Approval Standard for Class 1 "Insulated Steel Deck Roofs".
      b. FMG 4470: Approval Standard Class 1 "Roof Covers"
      c. FMG "Approval Guide"

F. 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 will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

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 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

B. Emergency Equipment: Maintain on-site equipment necessary to apply emergency temporary edge seal in the event of sudden storms or inclement weather.

C. Coordinate between various trades to avoid unnecessary rooftop traffic over sections of the roof and to prevent damage to the membrane. Heavily traveled areas shall be protected by placing temporary protection courses to prevent damage to the membrane.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of

membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, vapor barrier walkway products, and other components of membrane roofing system.
2. Include agreement to maintain roof and base flashing in a watertight condition for period of warranty. Warranty coverage shall include:
   a. Base ply materials, fasteners and adhesives.
   b. Roof membrane components and adhesives.
   c. All accessory products required for installation of membrane roofing system, including flashing plies and vapor retarder.
   d. Roof insulation, substrate boards, cover boards, and fasteners.
3. Warranty shall not exclude coverage as a result of winds of 90 m.p.h. or less.
4. Warranty Period: 30 years from date of Substantial Completion.

B. Special Warranty for Polyisocyanurate Insulation: Upon completion of the work, provide polyisocyanurate insulation manufacturer's twenty (20) year warranty stating that the thermal resistance of the insulation shall not vary more than 20% from its published value. Upon notification of such defects, within the warranty period, make the necessary repairs or replacements, including cost of materials and labor, at the convenience of the Owner.

PART 2 - PRODUCTS

2.1 TPO MEMBRANE ROOFING

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible TPO sheet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. "Sure-Weld TPO" (Carlisle SynTec Incorporated).
   b. "Ultraply TPO" (Firestone Building Products Company).
   c. "EverGuard TPO" (GAF Materials Corporation).
   d. "GenFlex TPO HY" (GenFlex Roofing Systems).
   e. "Tiempo 2000+TPO" (Dow Roofing).
   f. "Versiweld TPO Fully Adhered Membrane" (Versico Incorporated).
2. Thickness: 80 mils (2.0 mm), nominal , nominal.
3. Exposed Face Color: As selected by the Architect from Manufacturer’s colors meeting the solar reflectance index (SRI) requirements.
4. Physical Properties:
   a. Breaking Strength: 350 lbf(1.6 kN); ASTM D 751, grab method.
   b. Elongation at Break: 15 percent; ASTM D 751.
   c. Tearing Strength: 55 lbf(245 N) minimum; ASTM D 751, Procedure B.
   d. Brittleness Point: Minus 40 deg F(40 deg C).
   e. Ozone Resistance: No cracks after sample, wrapped around a 3-inch-(75-mm-) diameter mandrel, is exposed for 166 hours to a temperature of 104 deg F(40 deg C) and an ozone level of 100 pphm(100 mPa); ASTM D 1149.
   f. Resistance to Heat Aging: 90 percent minimum retention of breaking strength, elongation at break, and 60% of tearing strength after 670 hours at 240 deg F(116 deg C); ASTM D 573.

g. Water Absorption: Less than 3 percent mass change after 166 hours' immersion at 158 deg F(70 deg C); ASTM D 471.
h. Linear Dimension Change: Plus or minus 1 percent; ASTM D 1204.

B. Roofing System Assemblies: Provide the following roofing system assemblies complete with adhesives, fasteners and accessories to comply with performance criteria:
1. Walkways: Where indicated.
2. TPO Membrane: Adhered.
3. Cover board: Adhered.
4. Insulation: Tapered insulation.
5. Metal Roof Deck.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane 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 when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
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. Single-Ply Roof Membrane Adhesives: 250 g/L.
f. Other Adhesives: 250 g/L.
g. Single-Ply Roof Membrane Sealants: 450 g/L.
h. Nonmembrane Roof Sealants: 300 g/L.
i. Sealant Primers for Nonporous Substrates: 250 g/L.
j. Sealant Primers for Porous Substrates: 775 g/L.

B. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as sheet membrane.

C. Bonding Adhesive: Manufacturer's standard.

D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

F. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.3 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch (16 mm) thick.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Georgia-Pacific Corporation; Dens Deck Prime.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.4 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by TPO membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class I, Grade 2, felt or glass-fiber mat facer on both major surfaces.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) 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.

2.5 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

E. Cover Board: Provide one of the following:
   1. ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch (13 mm) thick, factory primed.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Georgia-Pacific Corporation; Dens Deck Prime.
   2. ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 3/8 inch (10 mm) thick.

a. Products: Subject to compliance with requirements, provide one of the following:
   1) USG Corporation; Securock.

F. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

2.6 WALKWAYS

A. Heat Weldable Walkway Rolls: Designed to protect roofing membrane in those areas exposed to repetitive foot traffic or other hazards, with slip resistant top surface pattern.
   1. Color: Match membrane color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. 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 will impair adhesion of roofing components to roof deck have been removed.
   7. Verify that insulation is dry:
      a. Perform one test for each 500 square feet of roof area.
      b. Perform 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.

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. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday

1. 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.
2. If roof drains will be temporarily blocked or unserviceable due to partial installation of new membrane roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under membrane roofing system components.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. 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 (6 mm) with insulation.
   1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
   1. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
   2. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

H. 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 (150 mm) in each direction. Loosely butt cover boards together and adhere to roof deck.

1. Adhere cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.5 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
   2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

I. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing membrane roofing system.

3.6 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings[and mechanically anchor to substrate through termination bars].

3.7 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Technical Representative: At the start of the installation and periodically as work progresses provide the services of the manufacturer's technical representative at the job site as often as deemed necessary by the manufacturer to advise on phases of this work.

B. Contractor's Field Quality Control Material Testing
   1. Field Seams: Provide inspection and testing of the field seams to assure manufacturer's quality requirements are maintained throughout the installation period. Inspect 100 percent of each field seam including expansion joints in the presence of the membrane manufacturer's representative. Obtain manufacturer's written report and submit for review prior to final acceptance.
   2. Fasteners: Provide one fastener pull out test for every 2,500 sq. ft. of roofing for the first 50,000 sq. ft. of roofing, and one for each 5,000 sq. ft. above the first 50,000 sq. ft., verifying the integrity of the fasteners and compliance with the specified performance criteria.

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
   1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

D. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

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

3.9 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing

system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

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

END OF SECTION

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SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Formed Low slope roofing fabrications.
2. Formed wall sheet metal fabrications.
3. Formed equipment support flashing.

B. Related Sections:
1. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section "Expansion Control" and "Manufactured Roof Expansion Joints for manufactured sheet metal expansion-joint covers.

1.2 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

1. Include plans, elevations, sections, and attachment details.
2. Provide F M Global approved details.
3. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
4. Include identification of material, thickness, weight, and finish for each item and location in Project.
5. Include details for forming, including profiles, shapes, seams, and dimensions.
6. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
7. Include details of termination points and assemblies.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including counterflashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1:5 (3 inches per 12 inches).

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
   2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
   3. Accessories and Miscellaneous Materials: Full-size Sample.
   4. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
   5. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.5 INFORMATIONAL SUBMITTALS

A. Delegated-Design Submittal: For Roof edge and coping wood nailer system, indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Qualification Data: For qualified fabricator, and engineer.

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

D. Product Certificates: For each type of coping and roof edge flashing that is SPRI ES-1 tested and FM Approvals approved.

E. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
   1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

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.

C. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of flashings in conjunction with waterproofing mockups.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.9 WARRANTY

A. Low slope roofing flashings are included in the Roofing Warranty, See Division 07 Roofing Sections.

B. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows 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. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Delegated Design: Design roof edge and coping wood nailer system at Tower and Tower Penthouse, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Design the wood nailer systems for the Podium, Buildings 30E and 38W in accordance with FM Global Data Sheet 1-49 Perimeter Flashing.

D. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent 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: 67 deg C (120 deg F), ambient; 100 deg C (180 deg F), material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

C. Metallic-Coated Steel Sheet: Restricted flatness 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. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
2. Surface: Smooth, flat.
3. Exposed Coil-Coated Finish:
   a. Two-Coat Fluoropolymer: AAMA 621. 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.

4. Color: Match Architect's samples.
5. Concealed Finish: Pretreat with 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 (0.013 mm).

D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; with smooth, flat surface.
   1. Finish: 2D (dull, cold rolled).

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
   1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
   2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
      b. Blind Fasteners: High-strength stainless-steel rivets suitable for metal being fastened.
   2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
   3. Fasteners for Zinc Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.

C. 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 (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

G. Solder:
1. For Stainless Steel: ASTM B 32, Grade Sn60 or Grade Sn96, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. For Zinc-Coated (Galvanized) Steel: ASTM B 32, with maximum lead content of 0.2 percent.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form 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.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

1. Fully soldered saddles at stainless-steel flashing t-joint intersections, sill-jamb and jamb-head transitions, and other transitions in stainless steel sheet metal flashing.

H. Do not use graphite pencils to mark metal surfaces.

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder metallic-coated steel sheet.
2. Do not use torches for soldering.
3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
4. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Base Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch (0.71 mm) thick.

B. Counterflashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch (0.71 mm) thick.

C. Flashing Receivers: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch (0.71 mm) thick.

D. Roof-Penetration Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch (0.71 mm) thick.

E. Equipment Support Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch (0.71 mm) thick.

F. Roof-Drain Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.016 inch (0.40 mm) thick.

2.7 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings with soldered joints, to extend beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams and ½ inch high upturned back leg. Fabricate from the following materials:
1. Stainless Steel: 0.016 inch (0.40 mm) thick.

B. Wall Flashing exposed to view: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch (0.71 mm) 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 the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 UNDERLAYMENT INSTALLATION

A. General: Install underlayment as indicated on Drawings.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

3.3 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, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. 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.
   3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
   4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
   5. Install sealant tape where indicated.
   6. Torch cutting of sheet metal flashing and trim is not permitted.
   7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of self-adhering sheet underlayment.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

F. Rivets: Rivet joints where indicated and where necessary for strength.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." 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 and weather resistant.

B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with sealant. Secure in a waterproof manner by means of anchor and washer at 36-inch (900-mm) centers.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

A. Install Opening flashings as follows unless otherwise indicated:
   1. Prepare surfaces so they are smooth and free from projections that could puncture flashing.
   2. Flashing above doors, mechanical louvers, and above and below windows to be continuous pieces with no seams and include end dams at both ends. Solder joints to form a continuous flashing surrounding the opening. Install all other flashings in lengths as long as possible with as few laps as possible. Place flashing on a continuous bed of mastic. Place termination bars in a full bed of mastic. Seal termination bars, flashing top edges and lap edges, laps, fasteners, additional and corner pieces, after installation with mastic or liquid-applied air barrier (consistent with the vertical leg material). Completely press flashings and termination bar into mastic.
   3. Extend flashing the full length of lintels and shelf angles, a minimum of 4" beyond ends of lintels, and form end dams minimum 6" beyond opening. Extend flashing ¼" out from exterior face with a ¼" drip edge, with hemmed edge. Terminate thru-wall flashings against back-up wall with a stainless steel compression termination bar set in a full bed of flashing adhesive mastic. At heads and sills turn up ends not less than 2" to form a pan. Provide a 1" wide thin band (on concrete and masonry, ½" on steel) of mastic under the front edge of flashing to retard water from infiltrating under the flashing, if flashings were to be placed on these materials. At end dams, provide vertical band of mastic against stone or brick to which flashing abuts. Place these thin bands slightly back from the front edge to not drip mastic on the building face and press flashing into thin bands.
   4. Overlap end joints of copper flashings not less than 6"; coat the contacting surfaces and seal lap with mastic. Provide 16" minimum overlaps for steps in flashings. Seal exposed edges with mastic. Copper flashings shall be continuous pieces above openings. Install all other flashings in lengths as long as possible with as few laps as possible. Use full height end dams where possible.
   5. At wall opening drip pans, provide wall flanges that extend beyond window opening jambs and terminate in alignment with and turn down 2 inches into sub-sill flashing at end dams. Seal into drip pan with mastic.
   6. Separate metal flashings from other dissimilar metals with continuous application of mastic, or as recommended by flashing manufacturer.
   7. Flashings shall be protected immediately following installation.

A. Drip Tray: Install drip tray in full and continuous contact with the top of the back-up wall to allow for transfer of window/curtain wall dead load. Integral to the drip tray provide a pre-formed drip, or form down turned leg that functions as a continuous keeper strip for sub-sill flashing installed below window opening; a preformed upturned leg that functions as a continuous back dam; pre-formed end dams at each jamb; and wall flanges that extend beyond window opening jambs and terminate in alignment with sub-sill flashing end dams. Where window openings require multiple sections of drip tray, spice joints shall be soldered air and water tight.

3.6 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. 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

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SECTION 07 72 00

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Roof hatches.

B. Related Sections:
1. Section 05 50 00 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.

1.2 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: For roof accessories.
1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

B. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Wind-Restraint Performance: As indicated on Drawings and in the wind design study.

2.2 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated single-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.

B. Manufacturers: Subject to compliance with the requirements, provide products by one of the following:
   a. Babcock-Davis.
   b. Bilco Company (The).
   c. J. L. Industries, Inc.
   d. Nystrom.

C. Basis of Design Product: Subject to compliance with the requirements, provide Bilco F-50TB thermally broken roof hatch, or provide a comparable product by on of the listed manufacturers.

D. Type and Size: Single-leaf lid, 48 by 48 inches (900 by 900 mm), unless otherwise indicated.

E. Loads: Minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 20-lbf/sq. ft. (0.95-kPa) internal uplift load.

F. Hatch Material: Aluminum sheet.
   1. Thickness: Manufacturer's standard thickness for hatch size indicated.
   2. Finish: Mill finish.

G. Construction:
   1. Insulation: Polyisocyanurate board.
      a. R-Value: 20.0 according to ASTM C 1363.
   2. Cover: Brakeformed, hollow-metal design with 3" (75 mm) concealed polyisocyanurate insulation (R Value of 20+), 5" (100 mm) beaded,

overlapping flange, fully welded at corners, and internally reinforced for 40 psf (195kg/m2) live load.

3. Curb: 12" (305 mm) in height with integral capflashing, 3" (75 mm) polyisocyanurate insulation (R Value of 20+), fully welded at corners, and 5-1/2" (114 mm) mounting flange with 7/16" holes (11 mm) provided for securing frame to the roof deck..
4. Gasket: Extruded EPDM rubber gasket permanently adhered to cover.
5. Hinges: Heavy-duty pintle hinges with 3/8" (9 mm) Type 316 stainless steel hinge pins.
6. Latch: Slam latch with interior and exterior turn handles and padlock hasps.
7. Lift Assistance: Compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with grip handle release.
8. Finish: Mill finish aluminum
9. Hardware: Engineered composite compression spring tubes and steel compression springs packed in grease. Type 316 stainless steel hinges. All other hardware is zinc plated/chromate sealed.
    a. Spring operators, hold-open arm, stainless-steel spring latch with turn handles, stainless-steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 inches (1060 mm) above finished roof deck.
3. Material: Stainless steel.
4. Post: 1-5/8-inch- (41-mm-) diameter pipe.

2.3 METAL MATERIALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

B. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

C. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

D. Steel Tube: ASTM A 500/A 500M, round tube.

E. Galvanized-Steel Tube: ASTM A 500/A 500M, round tube, hot-dip galvanized according to ASTM A 123/A 123M.

F. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.

C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

D. Underlayment:
1. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
2. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
3. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
4. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
5. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

E. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

F. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

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 the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

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

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.
   1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
   2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
   3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
   4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
   3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof Curb Installation: Install each roof curb so top surface is level.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Roof-Hatch Installation:
   1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
   2. Attach safety railing system to roof-hatch curb.
   3. Attach ladder-assist post according to manufacturer's written instructions.

F. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

B. Clean off excess sealants.

C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07 81 00

APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Sprayed Fire Resistive Materials (SFRM).

B. Related Sections include the following:
1. Division 05 Sections "Structural Steel Framing" "Steel Joists", "Steel Floor Deck", And "Steel Roof Deck" for surface conditions required for structural steel receiving applied fireproofing.
2. Division 07 Section "Penetration Firestopping" for fire-resistance-rated firestopping systems.
3. Division 07 Section "Joint Firestopping" for fire-resistance-rated joint systems.

1.2 DEFINITIONS

A. SFRM: Sprayed fire-resistive material.

B. Cementitious: Sprayed fire-resistive material using cementitious binders and adhesive materials complying with ASTM E 1513.

C. Concealed: Fire-resistive materials applied to surfaces that are concealed from view behind other construction when the Work is completed and have not been defined as exposed.

D. Exposed: Fire-resistive materials applied to surfaces that are exposed to view when the Work is completed, that are in vehicle parking area, that are in bulkhead mechanical rooms, and that are identified as exposed on Drawings.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Provide applied fireproofing materials and construction which are identical to those tested for the following fire performance characteristics, per test method indicated, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction.
1. Basis of Design: The basis for the design of applied fireproofing shall be that beams and columns are considered un-restrained unless otherwise noted or specified.
2. Fire Resistance Ratings: Indicated by design designation from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency acceptable to authorities having jurisdiction, for applied fire resistance material serving as direct applied protection tested as per ASTM E119.

3. UL design listings must state that the loading was determined by Allowable Stress Design Method or Load and Resistance Factor Design Method. UL design listings requiring a load restriction factor are not allowed.
4. Thickness and Density: ASTM E605, thickness and density as required by UL test to attain the fire endurance rating shown or as required by governing authorities for the application shown. Thickness shown is the minimum thickness required solely to determine clearances and, in case of conflict, the fire endurance rating prevails. For structural members of sizes not included in the UL beam and column designs, calculate the required fireproofing thickness in accordance with the equation listed in the UL "Fire Resistance Directory" for adjustment of applied protection material thickness.
5. Surface Burning Characteristics: As indicated for each applied fireproofing product required, tested per ASTM E84 and listed in UL "Building Materials Directory".
6. Content: Provide fireproofing products containing no detectable asbestos as determined according to the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, Polarized Light Microscopy.

B. Source Limitations: Obtain fireproofing from single source.

C. Engineering Judgment: For those fireproofing applications shown for which no UL tested design is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests is to be obtained and submitted to local authorities having jurisdiction for their review and approval prior to installation. Submit documentation to substantiate such review and approval.

1.4 ACTION SUBMITTALS

Product Data: Submit manufacturer's product data for each type of product specified showing compliance with performance requirements specified.

A. Applied Fireproofing Schedule: In lieu of Shop Drawings provide a schedule for structural elements proposed to receive spray-on fireproofing noting the following:
1. Indicate each column, girder, beam, truss, joist, floor deck and roof deck member or assembly to be fireproofed, include: size of member, required fire rating on member or assembly, U.L. design test no., minimum thickness required to achieve required fire resistance rating, material and finish required by location.
2. Indicate structural members which do not meet the minimum size requirements for a listed design, show calculations for required rating on beam, column or other structural member.
3. Locations and types of surface preparations required before applying fireproofing material.
4. Designation of restrained and unrestrained conditions based on definitions in ASTM E119, Appendix X3 as determined by a qualified Professional Engineer.
5. Locations of elements to receive sealer.

B. Shop Drawings: Structural framing plans indicating the following:
1. Locations and types of surface preparations required before applying fireproofing.

2. Extent of fireproofing for each construction and fire-resistance rating, including the following:
   a. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
   b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.
   c. Base all design designations on unrestrained members or submit designation of restrained and unrestrained conditions based on definitions in ASTM E 119, Appendix X3 as determined by a Professional Engineer licensed in Maine.
3. Treatment of fireproofing after application.

C. Samples for Verification: For each type of exposed fireproofing, two Samples, each 12 inches square, of each color, texture, and material formulation to be applied. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
1. Spray texture.
2. Roller texture.
3. Skip troweled texture.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates and Test Reports: For each type of fireproofing, signed by product manufacturer.
1. Submit test reports based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed fireproofing.
2. Submit test reports showing compliance with ASTM E1513 for cementitious content of SFRM.
3. Submit certification signed by manufacturer of intumescent paint components certifying that products selected comply with specified requirements, has been tested and certified by UL and meets the specified requirements.

B. Engineering Judgment: Copies of engineering judgment review and approval by local authorities having jurisdiction for fireproofing applications for which no UL tested design is available.

C. Qualification Data: For Installer, manufacturer, professional engineer, and testing agency.

D. Compatibility and Adhesion Test Reports: From fireproofing manufacturer indicating the following:
1. Materials have been tested for bond with substrates.
2. Materials have been verified by fireproofing manufacturer to be compatible with substrate primers and coatings.
3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

E. Product Test Reports: Indicate that physical properties of proposed sprayed fire-resistive materials comply with specified requirements based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed fireproofing.

1. Independent laboratory test reports of physical properties
2. U.L. Test Reports.

F. Research/Evaluation Reports: For fireproofing, from ICC-ES.

G. Field quality-control test and special inspection reports.

H. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its fireproofing to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

B. Source Limitations: Obtain each type of fireproofing through one source from a single manufacturer.

C. Testing: By a qualified testing and inspecting agency engaged by Contractor or manufacturer to test for compliance with specified requirements for performance and test methods.
1. SFRMs are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Testing is performed on specimens of SFRMs that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.
3. Testing is performed on specimens whose application the independent testing and inspecting agency witnessed during preparation and conditioning. Include in test reports a full description of preparation and conditioning of laboratory test specimens.

D. Compatibility and Adhesion Testing: Engage a qualified testing and inspecting agency to test for compliance with requirements for specified performance and test methods.
1. Test for bond per ASTM E 736 and requirements in UL's "Fire Resistance Directory" for coating materials. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
2. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with fireproofing.

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

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency acceptable to authorities having jurisdiction, for fireproofing serving as direct-applied protection tested per ASTM E 119.
2. Surface-Burning Characteristics: ASTM E 84.
3. Identify products with appropriate markings of applicable testing and inspecting agency.

F. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

G. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Extent of Mockups: Approximately 9 sq. m (100 sq. ft.) of surface for each product indicated to be review by the Architect. The mock-up installation will be at the site, at a location as mutually agreed upon by the Architect and the Applicator. Include in sample application typical columns, truss, beams, girders and decking if specified to be fireproofed. Provide material finishes complying with project requirements as to density and finish where exposed to view. Notify the Architect 48 hours I advance of mock-up review. Do not proceed with work until review of mock-up sample has been completed by the Architect.
2. After review of the mock-up, its location will be recorded and it will be retained and used as a standard of quality for the remainder of the fireproofing application.
3. The Architect's review of the mock-up sample installation will be for final acceptance of material finish appearance, conformance with design and general quality does not relieve the applicator from the responsibility and conformance with all herein specified requirements.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
Review methods and procedures related to fireproofing including, but not limited to, the following:
1. Review products, exposure conditions, design ratings, restrained and unrestrained conditions, calculations, densities, thicknesses, bond strengths, and other performance requirements.
2. Review and finalize construction schedule and verify sequencing and coordination requirements.
3. Review weather predictions, ambient conditions, and proposed temporary protections for fireproofing during and after installation.
4. Review surface conditions and preparations.
5. Review field quality-control testing procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.

B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.

C. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 4 deg C (40 deg F) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly.

C. Provide ventilation in space to receive sprayed material, introducing fresh air and exhausting air continuously during and 24 hours after application to maintain nontoxic, unpolluted, safe working area. Provide temporary enclosures to prevent spray from contaminating air. Protect adjacent surfaces and equipment from damage by overspray, fall-out and dusting-off of sprayed materials. Provide fire extinguisher and post caution signs warning against smoking and open flame when working with flammable materials.

1.9 COORDINATION

A. Sequence and coordinate application of fireproofing with other related work specified in other Sections to comply with the following requirements:
   1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
   2. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
   3. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.
   4. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
   5. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
   6. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

PART 2 - PRODUCTS

2.1 SPRAYED FIRE-RESISTIVE MATERIALS

A. Intermediate Durability SFRM Interior Locations, Concealed from view, for Buildings between 75 and 420 Feet Tall: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Grace Construction Products; W.R. Grace & Co. -- Conn; Monokote MK-10HB (concealed locations) or Monokote Z-106G (exposed locations).
      b. Carboline Company; RPM International; AD Southwest Fireproofing Type 5MD (concealed and exposed locatins).
      c. Isolatek International, Inc; Cafco 300HS , (concealed locations) Cafco 400 (exposed locations).
   2. Bond Strength: Minimum 430-lbf/sq. ft. (20.59-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
   3. Density: Not less than 15 lb/cu. ft. (240 kg/cu. m) and as specified in the approved fire-resistance design, according to ASTM E 605.
   4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
   5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 0.
      b. Smoke-Developed Index: 0.
   6. Compressive Strength: Minimum 30 lbf/sq. in. (206 kPa) according to ASTM E 761.
   7. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
   8. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
   9. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
   10. Air Erosion: Maximum weight loss of 0.0 g/sq. ft. (0.0 g/sq. m) in 24 hours according to ASTM E 859.
   11. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21.
   12. Concealed Finish: Spray-textured finish

B. High Durability SFRM Exterior Locations, Exposed to View, for Buildings between 75 and 420 Feet Tall: Manufacturer's standard, factory-mixed, High density, cementitious fireproofing, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Grace Construction Products; W.R. Grace & Co. -- Conn; Monokote Z-146
      b. Carboline Company; RPM International; Pyrocrete 40
      c. Isolatek International, Inc; FENDOLITE M-II

2. Bond Strength: Minimum 10,000 psf (640 kg/m3) cohesive and adhesive strength based on field testing according to ASTM E 736.
3. Density: Not less than 10,000 psf (478 kN/m2) and as specified in the approved fire-resistance design, according to ASTM E 605.
4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 0.
   b. Smoke-Developed Index: 0.
6. Compressive Strength: Minimum 500 psi (3.45 MPa) according to ASTM E 761.
7. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
8. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
9. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
10. Air Erosion: Maximum weight loss of 0.0 g/sq. ft. (0.0 g/sq. m) in 24 hours according to ASTM E 859.
11. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21.
12. Concealed Finish: Spray-textured finish.
13. Exposed Finish: Hand troweled smooth.

2.2 AUXILIARY FIRE-RESISTIVE MATERIALS

A. General: Provide auxiliary fire-resistive materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: For use on each substrate and with each sprayed fire-resistive product, provide primer that complies with one or more of the following requirements:
   1. Primer's bond strength complies with requirements specified in UL's "Fire Resistance Directory" for coating materials based on a series of bond tests per ASTM E 736.
   2. Primer is identical to those used in assemblies tested for fire-test-response characteristics of fireproofing per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of SFRM.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistance designs indicated and fire-resistive material manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive SFRM.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by manufacturer of SFRM.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by manufacturer of intumescent mastic coating fire-resistive material. Include pins and attachment.

G. Sealer: Tested and approved for installation by cementitious fireproofing manufacturer, tinted for visual observation. Provide one of the following or approved equal:
   1. "Firebond Concentrate and Firebond Adhesive" by Fiberlock Technologies, Inc.
   2. "Cafco Bond-Seal" by Isolatek International Corp.
   3. "TC 55 " by Southwest Fireproofing Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:
   1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.
   2. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
   3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
      a. Where these items are installed after application of spray fireproofing, return to the site and apply additional spray fireproofing to maintain fire rating of items to be fireproofed.
   4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.

B. Verify that concrete work on steel deck has been completed.

C. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

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

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.

B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible primers, paints, and encapsulants.

C. Prime substrates where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive applied fireproofing.

D. Clean bare metal surfaces thoroughly of foreign matter such as mortar, plaster, grease, rust, scale and dirt before priming coat is applied. Remove oil, grease and similar contaminants in accordance with SSPC SP-1 "Solvent Cleaning", prior to additional surface preparation specified.

E. Following cleaning, provide surface preparation of steel to comply with SSPC-SP 6 "Commercial Blast Cleaning," where recommended in writing by fireproofing manufacturer.

F. Verify that substrates are free of substances capable of interfering with bond, in accordance with manufacturer's requirements for acceptance of substrates.

G. Repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of intumescent fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION, GENERAL

A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

B. Apply fireproofing that is identical to products tested as specified in Part 1 "Quality Assurance" Article and substantiated by test reports, with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.

C. Install metal lath and reinforcing fabric, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath and fabric to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by fireproofing manufacturer. Attach accessories where indicated or required for secure attachment of lath and fabric to substrate.

D. Coat substrates with bonding adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by fireproofing manufacturer for material and application indicated.

E. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by fireproofing manufacturer, install body of fire-resistive covering in a single course.

F. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

G. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.

H. Where sealers are used, apply products that are tinted to differentiate them from SFRM over which they are applied.

I. Sealer: Mask off adjoining surfaces not scheduled to receive sealer and apply sealer evenly.

3.4 SFRM APPLICATION

A. Apply SFRM in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if specified in Part 2 "Concealed SFRM" Article.

B. Apply water overspray to concealed sprayed-fiber fire-resistive material as required to obtain designated fire-resistance rating.

C. Cure SFRM according to product manufacturer's written recommendations.

D. Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

E. Sealers: Apply to exposed SFRM, use products that are tinted to differentiate them from fireproofing over which they are applied.

F. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

G. Repair or replace work that has not successfully protected steel.

H. Cure fireproofing according to fireproofing manufacturer's written instructions.

I. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

J. Finishes: Where indicated, apply fireproofing to produce the following finishes:
   1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
   2. Spray-Textured Finish: Finish left as spray applied with no further treatment.

3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.
4. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections and prepare reports:
   1. SFRM.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
   1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

C. Tests and Inspections: Testing and inspecting of completed applications of SFRM shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of SFRM for the next area until test results for previously completed applications of SFRM show compliance with requirements. Tested values must equal or exceed values indicated and required for approved fire-resistance design.
   1. Thickness for Floor, Roof, and Wall Assemblies: For each 1000-sq. ft. area, or partial area, on each floor, from the average of 4 measurements from a 144-sq. in. sample area, with sample width of not less than 6 inches per ASTM E 605.
   2. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.
   3. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
   4. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: For each 929 sq. m (10,000-sq. ft.) area, or partial area, on each floor, cohesion and adhesion from one sample of size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 736.
      a. Field test SFRM that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
      b. If surfaces of structural steel receiving SFRM are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf/sq. ft. minimum per ASTM E 736.
      c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.

5. If testing finds applications of SFRM are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.

D. Remove and replace applications of fireproofing that do not pass tests and inspections for cohesion and adhesion, for density, or for both and retest as specified above.

E. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate that thickness does not comply with specified requirements, and retest as specified above.

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

3.6 CLEANING, PROTECTING, AND REPAIR

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Substantial Completion.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect fireproofing and patch any damaged or removed areas.

D. Provide patching and repairing of sprayed fireproofing damaged by other trades after application under the work for this section. Costs for such repair and patching will be borne by the trade or Subcontractor or Contractor causing the damage. The General Contractor is to coordinate the costs of repair work between the Subcontractors or Contractors for this repair and patch work with no additional cost to the Owner for such work

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SECTION 07 81 23

INTUMESCENT FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes mastic and intumescent fire-resistive coatings.

B. Related Requirements:
1. Section 07 81 00 "Applied Fireproofing" for sprayed fire-resistive materials (SFRM).

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Framing plans or schedules, or both, indicating the following:
1. Extent of fireproofing for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of fireproofing after application.

C. Samples: For each exposed product and for each color and texture specified, 4 inches (102 mm) square minimum in size.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates and Test Reports: For each type of fireproofing, signed by product manufacturer.
1. Submit test reports based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed fireproofing.
2. Submit certification signed by manufacturer of intumescent paint components certifying that products selected comply with specified requirements, has been tested and certified by UL and meets the specified requirements.

B. Engineering Judgment: Copies of engineering judgment review and approval by local authorities having jurisdiction for fireproofing applications for which no UL tested design is available

C. Qualification Data: For Installer and testing agency.

D. Product Test Reports: Indicate that physical properties of proposed sprayed fire-resistive materials comply with specified requirements based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed fireproofing.
   1. Independent laboratory test reports of physical properties
   2. U.L. Test Reports.

E. Product Certificates: For each type of fireproofing.

F. Evaluation Reports: For fireproofing, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

B. Source Limitations: Obtain each type of fireproofing through one source from a single manufacturer.

C. Testing: By a qualified testing and inspecting agency engaged by Contractor or manufacturer to test for compliance with specified requirements for performance and test methods.
   1. Fire Resistive Paint Coating (Intumescent) Material Quality: Provide materials that have been tested in accordance with CAN/ULC-S101 which will result in fire resistive ratings equivalent to ASTM E119 or UL263 and are listed in the UL or ULC "Building Materials Directory" with each paint container bearing a UL or ULC Label

D. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

E. Fire-Test-Response Characteristics: Provide fireproofing with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify packaging with appropriate markings of applicable testing and inspecting agency.
   1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" acceptable to authorities having jurisdiction, for fireproofing serving as direct-applied protection tested per ASTM E 119.
   2. Surface-Burning Characteristics: ASTM E 84.
   3. Identify products with appropriate markings of applicable testing and inspecting agency.

F. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Build mockup of each type of fireproofing and different substrate and each required finish as shown on Drawings.

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

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 50 deg F (10 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fireproofing from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. Asbestos: Provide products containing no detectable asbestos.

2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

A. Mastic and Intumescent Fire-Resistive Coating: Manufacturer's standard, factory-mixed, multicomponent system consisting of intumescent base coat and topcoat, and complying with indicated fire-resistance design.
1. Basis of Design Manufacturer/Product: Subject to compliance with requirements, provide Isolatek International; CAFCO SprayFilm WB 5, or comparable products by one of the following:
   a. Albi Manufacturing; a division of StanChem, Inc.
   b. Carboline Company; a subsidiary of RPM International.
   c. Hilti, Inc.
   d. International Protective Coatings.
   e. Isolatek International.
2. Application: Designated for "interior general purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.

3. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
4. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.
5. Hardness: Not less than 80, Type D durometer, according to ASTM D 2240.
6. Finish: Rolled, spray-textured finish.
   a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

E. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.
1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
   1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
   2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

E. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

F. Extend fireproofing in full thickness over entire area of each substrate to be protected.

G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

H. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

I. Cure fireproofing according to fireproofing manufacturer's written instructions.

J. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

K. Finishes: Where indicated, apply fireproofing to produce the following finishes:
   1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
   2. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Test and inspect as required by the IBC, Subsection 17 05 .14, "Mastic and Intumescent Fire-Resistant Coatings."

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.
   1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
   2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION

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SECTION 07 84 13

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

B. Related Sections:
1. Division 07 Section "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.2 PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.
1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
3. Fire-resistance-rated floor assemblies.
4. Fire-resistance-rated roof assemblies.

B. Rated Systems: Provide penetration firestopping systems with the following ratings determined per ASTM E 814 or UL 1479:
1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
   a. Penetrations located outside wall cavities.
   b. Penetrations located outside fire-resistance-rated shaft enclosures.
   c. Penetrations into storage areas containing combustible materials.
3. L-Rated Systems: Where through-penetration firestop systems are indicated in smoke barriers, provide through-penetration firestop systems with L-ratings of not more than 0.01524 cu. m/s x sq. m (3.0 cfm/sq. ft) at both ambient temperatures and 204 deg C (400 deg F).
4. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
   1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
   2. For floor penetrations with annular spaces exceeding 100 mm (4 inches) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
   3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

E. Systems and Product Selection:
   1. When not shown on the Drawings, it is the Installing Contractor's undivided responsibility to select proposed systems and products which are appropriate for the types of penetrations, construction systems and the required fire resistance ratings shown on the Drawings and which comply with the requirements of this specification, subject to review by the Architect.
   2. Proprietary products and UL designs when indicated on the Drawings are not intended to imply that products and UL designs of the manufacturer are required to the exclusion of equivalent products of other named acceptable manufacturers.

F. FM Approvals' Listing: Fire-resistive joint systems shall be F M Global approved. Identify materials with FM Approvals Certification markings.

1.3 SUBMITTALS

A. Product Data: For each type of through-penetration firestop system product indicated.

B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
   1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.

C. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
   1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
   2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular penetration firestopping condition, submit engineers judgment drawing developed by through-

penetration firestop system manufacturer's fire-protection engineer in accordance with the provisions of the International Firestop Council.

D. Samples: Submit manufacturer's standard color samples for selection by Architect for exposed to view through-penetration firestop systems.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that their products comply with specified requirements.

G. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

H. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.
   1. Classified System drawings from the Underwriters Laboratories Fire Resistance Directory Volume 2.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors."

B. Source Limitations: Obtain through-penetration firestop systems from a single manufacturer.

C. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.

D. Provide through-penetration firestop systems products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

E. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that shall comply with the following requirements and those specified in "Performance Requirements" Article:
   1. Firestopping tests are performed by a qualified testing and inspection agency. A qualified testing and inspecting agency is UL, ITS, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
   2. Through-penetration firestop systems are identical to those tested per ASTM E 814, under conditions where positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the

fill materials surrounding the penetrating items in the test assembly.. Provide rated systems complying with the following requirements:

a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
    1) UL in its "Fire Resistance Directory." by ITS, Warnock Hersey, or by another qualified testing and inspecting agency.
    2) FM Global in its "Building Materials Approval Guide."

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

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multi-component materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.
1. Store materials, between 60 degrees F. and 80 degrees F. If exposed to lower temperature, restore to proper temperature before using.
2. Store materials, in dry area and protect. Replace damaged materials at Contractor's expense.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate size and location of cast-in-place firestop devices to accommodate planned pipe and cable runs. Ensure proper placement of devices before placement of concrete.

B. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

C. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

D. Notify Owner's testing and inspection agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

E. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. HiltiConstruction Chemicals, Inc, Tulsa, OK 74146.
2. Flamesafe - W.R. Grace & Co., Hatfield, PA 19440
3. The RectorSeal Corporation, Houston, TX 77023.
4. Specified Technologies Co., Sommerville, NJ 08876.
5. 3M Fire Protection Products.
6. Tremco, Inc.; Tremco Fire Protection Systems Group.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. Horizontal assemblies include floors floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

4. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

G. Provide sealants and putties that are integrally colored by manufacturer so they are readily identifiable as firestopping products. White or light colored products, or field-colored products will not be acceptable.

H. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required and comply with "Performance Requirements" Article. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated. Accessories include, but are not limited to, the following items:
   1. Permanent forming/damming/backing materials, including the following:
      a. Semirefractory -fiber or slag/rock-mineral wool-insulation.
      b. Ceramic fiber.
      c. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
      d. Fire-rated form board.
      e. Joint Fillers for joint sealants.
   2. Temporary forming materials.
   3. Substrate primers.
   4. Collars.
   5. Steel sleeves.

2.3 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by reference to the types of materials described in this Article. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic or plastic casing lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Moisture Curing, ingle-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other sloped surfaces or plastic casing surfaces requiring a non-slumping, gunnable sealant, unless indicated firestopping limits use to nonsag grade for both opening conditions.

L. Intumescent Acrylic Sealant: Firestop sealant that expands when exposed to heat. Protects penetrations containing combustible and non-combustible penetrants.

M. Foam "sponge-line" Blocks: Re-penetratable intumescent blocks that may be friction fit, deformed, or cut to fit in through penetration openings.

N. Firestop Sleeve Device: Factory assembled sleeves formed from galvanized steel and lined with intumescent material designed to fit specific diameter of penetrant.

O. Polyurethane Firestop Foam: Two component polyurethane foam created through chemical reaction of polyol, water and polyisocyanate, plus flame retardants and other additives (all included in the polyol component). Foam cures within one minute at room temperature to produce non-shrinking smoketight firestopping system and does not require additional firestop coating.
   1. Acceptable Product: CP620 Fire Foam by Hilti.
   2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.

3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

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

C. Follow manufacturer’s application and installation instructions. In situations where the requirements of this Section differ from those of the manufacturer, the more conservative requirements shall govern.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
1. Remove all foreign materials from surfaces of opening joint substrates and from penetrating items that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect through-penetration firestop systems and to prepare test reports.
   1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.
   2. Do not enclose through--penetration firestop systems comply with or deviate from requirements.
   3. Inspection agency shall verify that installed systems are in accordance with either a UL-classified system or engineer judgement drawing as described in Part 1.

B. Inspections: Provide on-site inspections for fire stops in accordance with ASTM E2174, and on-site inspections for fire resistive joint systems and perimeter fire barriers in accordance with ASTM E2393 as the work progresses. Verify that firestopping systems have been constructed in compliance with the submitted designs for fire rating required by the Contract Documents and are acceptable to Authorities having jurisdiction.
   1. Visual inspection of substrates before installation of firestopping to ascertain that preparation has been performed in accordance with the Contract Documents.
   2. Visual inspection of completed work including removal of damming materials if used to ensure an adequate and complete fire and smoke seal.
   3. Final inspection after other trades have completed Work in contact with firestopping material, but before firestopping material is covered.

C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.

D. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.6 PENETRATION FIRESTOPPING SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
   1. Equivalent approved systems by the following are acceptable:
      a. Intertek ETL SEMKO-approved systems that are listed by design numbers in Intertek ETL SEMKO's "Directory of Listed Building Products" under "Firestop Systems."
      b. FM Global-approved systems that are listed by design numbers in FM Global's "Building Materials Approval Guide" under "Wall and Floor Penetration Fire Stops."

B. Firestop systems used for Laboratory floors: W-Rating: No leakage of water at completion of water leakage testing.

C. Firestop Systems for pipes, plastic or metal, conduit in vertical runs, installed through firestop devices: Comply with the following:
   1. Acceptable UL-Classified Systems with FA 1000 Series Systems equivalent to, but not limited to, the following:
      a. FA1016, FA1017, FA2053, FA2054, FA2066, FA2103, FB5004, FA1128, FA2213, FA5046, FB1026 and FB2048 by Hilti.
   2. Type of Firestop Device:
      a. CP 680-P/M Cast-in Firestop Device by Hilti.
      b. CFS-DID Firestop Drop-In Device by Hillti.

D. Firestop Systems with No Penetrating Items: Comply with the following:
   1. Acceptable UL-Classified Systems with CAJ 0000 Series Systems equivalent to, but not limited to, the following:
      a. CAJ0055, CAJ0070, CAJ0090, CAJ0097 by Hilti.
      b. CAJ0012, CAJ0102 by RectorSeal.
      c. CAJ0011, CAJ0130, CAJ0096, CLIV by Tremco TREMstop Firestopping.
   2. Type of Fill Materials: One or more of the following:
      a. Latex sealant.
      b. Silicone sealant.
      c. Acrylic sealant.

d. Intumescent putty.
e. Mortar.
f. Preformed intumescent blocks/plugs.
g. Pillows/Bags

E. Firestop Systems for Metallic Pipes, Conduit, or Tubing: Comply with the following:
1. Acceptable UL-Classified Systems with CAJ, WL, or FC 1000 Series Systems, equivalent to, but not limited to, the following:
a. CAJ1184, CAJ1226, CAJ1291, CAJ1277, CAJ1382, CAJ1388, WL1054, WL1249, FC1009 by Hilti.
b. CAJ1403, CAJ1235, CAJ1406, WL1152, WL1207, FC1020 by RectorSeal.
c. CAJ1064, CAJ1302, CAJ1448, CAJ1529, CAJ1518, TL/PV 120-04, WL1158, WL1302, WL1328 – Tremco TREMstop Firestopping.
2. Type of Fill Materials: One or more of the following:
a. Latex sealant.
b. Silicone sealant.
c. Acrylic sealant.
d. Intumescent putty.
e. Mortar.
f. Polyurethane firestop foam.

F. Firestopping for Nonmetallic Pipe, Conduit, or Tubing: Comply with the following:
1. Acceptable UL-Classified Systems with CAJ, FA, or WL 2000 Series Systems, equivalent to, but not limited to, the following:
a. CAJ2109, CAJ2167, CAJ2271, CAJ2342, FA2053, WL2078, WL2128 by Hilti.
b. CAJ2212, CAJ2171, CAJ2210, WL2167, WL2185, WL2170, WL2259 by RectorSeal.
c. CAJ2184, CAJ2615, CAJ2618, CAJ2621, TL/PH 120-05, TL/PH 120-06, WL2129, WL2463, WL2463 – Tremco TREMstop Firestopping.
2. Type of Fill Materials: One or more of the following:
a. Intumescent sealant.
b. Intumescent putty.
c. Intumescent wrap strips.
d. Firestop device.
e. Firestop sleeve device.
f. Latex sealant.

G. Firestop Systems for Electrical Cables: Comply with the following:
1. Acceptable UL-Classified Systems with CAJ, FC, or WL 3000 Series Systems, equivalent to, but not limited to, the following:
a. CAJ3095, FC3012, WL3065, WL3112 by Hilti.
b. CAJ3185, CAJ3199, CAJ3234, FC3018, FC3060, WL3179 by RectorSeal.
c. CAJ3141, CAJ3297, CAJ3036, CAJ3228, CAJ3237, WL3131, WL3346, FC3037, FC3085 – Tremco TREMstop Firestopping.
2. Type of Fill Materials: One or more of the following:
a. Intumescent sealant.
b. Latex Sealant
c. Pillows/bags
d. Intumescent putty.
e. Silicone foam.

H. Firestopping for Cable Trays with Electric Cables: Comply with the following:
   1. Acceptable UL-Classified Systems with CAJ or WL 4000 Series Systems equivalent to, but not limited to, the following:
      a. CAJ4035, CAJ4054, WL4011, WL4038 by Hilti.
      b. CAJ4035, CBJ4023, WL4025, WL4030 by RectorSeal.
      c. WJ4053, WL4056 – Tremco TREMstop Firestopping.
   2. Type of Fill Materials: One or more of the following:
      a. Intumescent sealant.
      b. Intumescent putty.
      c. Silicone foam.
      d. Pillows/bags.
      e. Foam blocks.
      f. Firestop mortar.
      g. Polyurethane firestop foam.

I. Firestop Systems for Insulated Pipes: Comply with the following:
   1. Acceptable UL-Classified Systems with CAJ or WL 5000 Series Systems, equivalent to, but not limited to, the following:
      a. CAJ5091, WL5029 by Hilti.
      b. CAJ5222, WL5171 by RectorSeal.
      c. CAJ5111, CAJ5121, CAJ5287, CAJ5324, WL5081, WL5115, CAJ5083, FC5055 – Tremco TREMstop Firestopping.
   2. Type of Fill Materials: One or more of the following:
      a. Intumescent sealant.
      b. Silicone foam.
      c. Intumescent wrap strips.
      d. Pre-formed intumescent blocks.
      e. Latex sealant.

J. Firestop Systems for Miscellaneous Electrical Penetrants: Comply with the following:
   1. Acceptable UL-Classified Systems with CAJ 6000 Series Systems equivalent to, but not limited to, the following:
   2. CAJ6006, CAJ 6017 by Hilti.
   3. CAJ6012, CAJ6013, CAJ6027 by RectorSeal.
   4. Type of Fill Materials: One or more of the following:
      a. Intumescent sealant.
      b. Latex sealant
      c. Intumescent putty.
      d. Mortar.

K. Firestop Systems for Miscellaneous Mechanical Penetrations: Comply with the following:
   1. Acceptable UL-Classified Systems with CAJ 7000 Series Systems equivalent to, but not limited to, the following:
      a. CAJ7046, CAJ7051 by Hilti.
      b. CAJ7067, CAJ7075, CAJ7082 by RectorSeal.
      c. CAJ7090, CAJ7136, CAJ7139, CAJ7002, WL7039, WL7113, WL7125, WL7172 – Tremco TREMstop Firestopping.
   2. Type of Fill Materials: One or both of the following:
      a. Intumescent sealant.
      b. Latex sealant.

c. Mortar.
d. Acrylic sealant.
e. Silicone sealant.

L. Firestop Systems for Groupings of Penetrations: Comply with the following:
1. Acceptable UL-Classified Systems with CAJ or WL 8000 Series Systems, equivalent to, but not limited to, the following:
a. CAJ8056, CAJ8096, WJ8007, WL8014, WL8019 by Hilti.
b. CAJ8042, CAJ8101, CAJ8133, WL8007 by RectorSeal.
c. CAJ8134, CAJ8111, CAJ8158 – Tremco TREMstop Firestopping.

2. Type of Fill Materials: One or more of the following:
a. Latex sealant.
b. Mortar.
c. Intumescent wrap strips.
d. Firestop device.
e. Intumescent composite sheet.
f. Pre-formed intumescent blocks.
g. Polyurethane firestop foam.

END OF SECTION

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SECTION 07 84 43

JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

B. Related Sections:
1. Section 07 84 13 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
2. Section 07 95 00 "Expansion Control" for fire-resistive architectural joint systems.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed and relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.
2. Where project conditions require modification of qualified testing and inspecting agency’s illustration to suit a particular through-penetration firestop condition, submit engineer judgement drawing developed by joint firestop system manufacturer’s fire-protection engineer in accordance with the provisions of the International Firestop Council.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors."

B. Source Limitations: Obtain fire-resistive joint systems from a single manufacturer.

C. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
   1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
      a. Fire-resistive joint system products bear classification marking of qualified testing agency.
      b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
         1) UL in its "Fire Resistance Directory."
         2) Intertek ETL SEMKO in its "Directory of Listed Building Products."
         3) FM Global in its "Building Materials Approval Guide."

D. Installer Training: Individuals performing the installation of fire-resistive joint systems shall be trained by a direct representative of the fire-resistive joint systems materials manufacturer, not a distributor or agent.

E. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

D. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Provide fire-resistive joint systems that are produced, tested and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.

B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, and with movement capabilities, W and L-ratings indicated as determined by UL 2079 (ASTM E1966) under a positive pressure differential not less than 0.01 in. water column and classified with ratings for fire resistance, leakage, and movement capability to meet the specified requirements.

C. Perimeter Fire-Containment (Barrier) Systems: For joints between edges of fire-resistance-rated floor assemblies and exterior wall assemblies, provide systems of type as determined by NFPA 285 and ASTM E2307 under positive pressure differential of not less than 0.01 in. water column and classified with ratings for integrity, insulation, leakage, and movement capability to meet the specified requirements.
   1. UL listed, Fire Resistance of Perimeter Fire-Containment Systems: Integrity and insulation ratings equal or exceeding fire resistance ratings of floor or floor wall and floor ceiling assembly forming one side of joint, as indicated as determined by applicable codes and UL 2079.

D. FM Approvals' Listing: Fire-resistive joint systems shall be F M Global approved. Identify materials with FM Approvals Certification markings.

E. For fire resistive joint systems assemblies exposed to view:
   1. Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
   2. At traffic, moisture and subject physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.

F. Building Movement: Provide fire resistive joint systems suitable to withstand building movements, including thermal movements, loading deflections, shrinkage, creep and similar movements, when tested in accordance with specified standards.

2.2 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Basis-of-Design Products: The design for each fire-resistive joint system is based on products named in Part 2 articles. Subject to compliance with requirements, provide either the named products or comparable products by one of the following:
      a. Hilti, Inc.
      b. RectorSeal Corporation.
      c. Specified Technologies Inc.
      d. 3M Fire Protection Products.
      e. Tremco, Inc.; Tremco Fire Protection Systems Group.

2.3 FIRE-RESISTIVE JOINT SYSTEMS

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
   1. Joints include those installed in or between fire-resistance-rated walls floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.

C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 2307 based on testing at a positive pressure differential of 2.49 Pa (0.01-inch wg).
   1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.
   1. L-Rating: Not exceeding 0.00775 cu. m/s x m (5.0 cfm/ft) of joint at 74.7 Pa (0.30 inch wg) at both ambient and elevated temperatures.

E. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain

ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

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

B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.5 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.6 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.
   1. Equivalent approved systems by the following are acceptable:
      a. Intertek ETL SEMKO-approved systems that are listed by design numbers in Intertek ETL SEMKO's "Directory of Listed Building Products" under "Firestop Systems."
      b. FM Global-approved systems that are listed by design numbers in FM Global's "Building Materials Approval Guide" under "Wall and Floor Penetration Fire Stops."

B. Floor-to-Floor, Fire-Resistive Joint System:
   1. Acceptable UL-Classified Products equivalent to, but not limited to, the following:
      a. FFD1013, FFD1039, FFD1047, FFD1087 by Hilti.
      b. FFD1024 & FFD1027 – RectorSeal Flamesafe®.
      c. FFD0042, FFD0073, FFD0074, FFD1057, FFD1085, FFD1058, FFD1060, FFD1061 – Tremco TREMstop Firestopping.
   2. Assembly Rating: Refer to Drawings.
   3. W-Rating: No leakage of water at completion of water leakage testing.

4. Nominal Joint Width: As indicated.
5. Movement Capabilities: Class II; refer to Drawings.

C. Wall-to-Wall, Fire-Resistive Joint System equivalent to, but not limited to, the following:
1. Acceptable UL-Classified Products:
   a. WWD0017, WWD0032, WWD0040 by Hilti.
   b. WWD1028 & WWD1029 – RectorSeal Flamesafe®.
   c. WWD1052 & WWD0089 – Tremco TREMstop Firestopping.
2. Assembly Rating: Refer to Drawings.
3. Nominal Joint Width: As indicated.
4. Movement Capabilities: Class II; refer to Drawings.

D. Floor-to-Wall, Fire-Resistive Joint System equivalent to, but not limited to, the following:
1. Acceptable UL-Classified Products:
   a. FWD1013, FWD1037, FWD1047, FWD1071 by Hilti.
   b. FWD1020 & FWD1024 – RectorSeal Flamesafe®.
   c. FWD1053, FWD0051, FWD1054, FWD1059 – Tremco TREMstop Firestopping.
2. Assembly Rating: Refer to Drawings.
3. W-Rating: No leakage of water at completion of water leakage testing.
4. Nominal Joint Width: As indicated.
5. Movement Capabilities: Class II; refer to Drawings.

E. Head-of-Wall, Fire-Resistive Joint System equivalent to, but not limited to, the following:
1. Acceptable UL-Classified Products:
   a. HWD0042, HWD0045, HWD0049, HWD1066, HWD0184, HWD0292, HWD0209, HWD0324, HWD0081, HWD0268, HWD1037, HWD1058, HWD0181 by Hilti.
   b. HWD0107, HWD0146, HWD0144, HWD1047, HWD1021, HWD1024, HWD0148, HWD0149, HWD0150, HWD-0267, HWD-0299,HWD-257 & HWD-0300– RectorSeal Flamesafe®.
   c. HWD0017, HWD0092, HWD0251, HWD1072, TL/PV 120-02, TL/PV 120-05, HWD1054, HWD1049, HWD0450, HWD0344 – Tremco TREMstop Firestopping.
2. Assembly Rating: Refer to Drawings.
3. Nominal Joint Width: As indicated.
4. Movement Capabilities: Class II; refer to Drawings.

F. Bottom-of-Wall, Fire-Resistive Joint Systems equivalent to, but not limited to, the following:
1. Acceptable UL-Classified Products:
   a. BWS0001c, BWS0002c, BWS0023a, by Hilti.
   b. FWD0051, FWD1069, FWD0035, FWD0036, FWD1053, FWD1056, FWD1057 – Tremco TREMstop Firestopping.
2. Assembly Rating: Refer to Drawings.
3. Nominal Joint Width: As indicated.
4. Movement Capabilities: Class II; refer to Drawings.

G. Perimeter Fire-Resistive Joint Systems equivalent to, but not limited to, the following:
   1. Acceptable UL Classified Products:
      a. CWD2026, CWD2027, CEJ127P, CEJ216P, CEJ244P, CEJ245P, CEJ246P, CEJ259P, CEJ260P, CEJ261P, CEJ262P, CEJ263P, CEJ307P, CEJ421P by Hilti.
      b. CEJ150P, CEJ151P, CEJ152P,CEJ153P, CEJ154P, CEJ-273P, CEJ-274P, CEJ-275P, CEJ-276P, CEJ-296P CEJ-297P, CEJ527P, CEJ528P & CEJ530P – RectorSeal Flamesafe®.
      c. CWD2043, CWS1016, TL/JS 120-03, TL/PH 120-01, CWD2044, CWD2045, TL/JS 120-04, TL/JS 90-01 – Tremco TREMstop Firestopping.
   2. Assembly Rating: Refer to Drawings.
   3. W-Rating: No leakage of water at completion of water leakage testing.
   4. Nominal Joint Width: As indicated.
   5. Movement Capabilities: Class II; refer to Drawings.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.

B. Related Sections:
1. Section 07 84 46 "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
2. Section 08 80 00 "Glazing" for glazing sealants.
3. Section 09 30 00 "Tiling" for sealing tile joints.

1.2 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
1. Use ASTM C 1087 or manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:
   a. Each kind of sealant and joint substrate indicated.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
   1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 13-mm- (1/2-inch-) wide joints formed between two 150-mm- (6-inch-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:
1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and testing agency.

B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

E. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

G. Field-Adhesion Test Reports: For each sealant application tested.

H. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

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

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.
1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

E. Mockups: See Section 01 45 34 Mockups for mockups requiring sealants.

F. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 5 deg C (40 deg F).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 5 years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated for each type in the sealant schedules at the end of Part 3.

2.2 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 demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
   1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant (Designation S-GB): Provide one of the following as required for joints indicated:
   1. ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Dow Corning Corporation; 790.
         2) GE Advanced Materials - Silicones; SilPruf LM SCS2700.
         3) Pecora Corporation; 890 or 890FTS.
         4) Sika Corporation, Construction Products Division; SikaSil-C990.
         5) Tremco Incorporated; Spectrem 1.
   2. ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) BASF Building Systems; Omniseal 50.
         2) Dow Corning Corporation; 756 SMS or 795.
         3) GE Advanced Materials - Silicones; SilPruf NB SCS9000, SilPruf SCS2000 or UltraPruf II SCS2900.
         4) Pecora Corporation; 864 or 895.
         5) Sika Corporation, Construction Products Division; SikaSil-C995.
         6) Tremco Incorporated; Spectrem 2 or Spectrem 3.

2.4 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant / Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant (Designation U-TB): Provide one of the following as required for joints indicated.
   1. ASTM C 920. Type S, Grade NS, Class 25, for Use T.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) BASF Building Systems; Sonolastic NP1, Sonolastic Ultra.
         2) Sika Corporation, Construction Products Division; Sikaflex - 1a.
         3) Tremco Incorporated; Vulkem 116.
   2. ASTM C 920, Type S, Grade P, Class 25, for Use T.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) BASF Building Systems; Sonolastic SL 1.
         2) Bostik, Inc.; Chem-Calk 950.
         3) Pecora Corporation; Urexpan NR-201.
         4) Schnee-Morehead, Inc.; Permathane SM7101.
         5) Sika Corporation. Construction Products Division; Sikaflex - 1CSL.
         6) Tremco Incorporated; Vulkem 45 or Vulkem 45 SSL.
   3. ASTM C 920, Type M, Grade NS, Class 25, for Use T.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) BASF Building Systems; Sonolastic NP 2.
         2) Pecora Corporation; Dynatred.

3) Sika Corporation, Construction Products Division; Sikaflex - 2c NS, Sikaflex - 2c EZ Mix.
4) Tremco Incorporated; Vulkem 227 or Dymeric 240FC.

2.5 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF (Designation L-GP).
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Building Systems; Sonolac.
b. Bostik, Inc.; Chem-Calk 600.
c. Pecora Corporation; AC-20+.
d. Schnee-Morehead, Inc.; SM 8200.
e. Tremco Incorporated; Tremflex 834.

2.6 JOINT SEALANT BACKING

A. General: Provide sealant backings of material 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: ASTM C 1330, Type C (closed-cell material with a surface skin) for all sealants, except silicone and horizontal joints. Type O (open-cell material) for silicone sealants. Provide size and density to control sealant depth and otherwise contribute to producing optimum sealant performance. Backings shall be approximately 25% larger than joint.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      a. Concrete.
      b. Masonry.
      c. Unglazed surfaces of ceramic tile.
      d. Exterior insulation and finish systems.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
      a. Metal.
      b. Glass.
      c. Porcelain enamel.
      d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

G. 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 silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 10 mm (3/8 inch). Hold edge of sealant bead 6 mm (1/4 inch) inside masking tape.
   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 sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.

I. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control 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 with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
   1. Extent of Testing: Test completed and cured sealant joints as follows:
      a. Perform 10 tests for the first (1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
      b. Perform 1 test for each (1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.
      c. For each failed test, perform two tests at additional locations at the Contractor’s cost.
      d. Perform additional tests at unique conditions. 3 tests at each.
   2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
      a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   3. Inspect tested joints and report on the following:
      a. Whether sealants filled joint cavities and are free of voids.
      b. Whether sealant dimensions and configurations comply with specified requirements.
      c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
   4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
   5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements 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 sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 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 original work.

3.7 JOINT-SEALANT SCHEDULE

A. Items Not to be Sealed:
   1. Joints covered by joint covers and seals specified in Division 07 Section "Expansion Joint Cover Assemblies."
   2. Penetrations in fire-rated assemblies. Use firestop sealants as specified in Division 07 Section "Penetration Firestopping."
   3. Joints in and perimeter of fire-rated assemblies. Use firestop sealants as specified in Division 07 Section "Fire-Resistant Joint Sealants."
   4. Joints, perimeter, and penetrations in sound-rated assemblies. Use acoustical sealant. Installation is specified with sound-rated assembly in Division 09 Section "Gypsum Board."
   5. Weep holes in masonry, storefront, and windows.

B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
   1. Joint Locations:
      a. Isolation and contraction joints in cast-in-place concrete slabs.
      b. Other joints as indicated.
   2. Urethane Joint Sealant: Single component, pourable, traffic grade or multicomponent, nonsag, traffic grade, Class 25. (Designation U-TB)
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Construction joints in cast-in-place concrete.
      b. Joints between plant-precast architectural concrete units.
      c. Joints in Portland cement plaster system, including preformed control and expansion joints.
      d. Joints between metal panels.
      e. Joints between different materials listed above.
      f. Perimeter joints between materials listed above and frames of doors, windows and louvers.
      g. Other joints as indicated.

2. Silicone Joint Sealant: Single component, nonsag, neutral curing Class 100/50 or Single component, nonsag, neutral curing, Class 50. (Designation S-GP)
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Joint Locations:
   a. Isolation joints in cast-in-place concrete slabs.
   b. Control joints in cast-in-place concrete slabs.
   c. Other joints as indicated.
2. Urethane Joint Sealant: Single component, nonsag / pourable, traffic grade or multicomponent, nonsag, traffic grade, Class 25. (Designation U-TB)
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints of exterior openings where indicated.
   c. Other joints as indicated.
2. Urethane Joint Sealant: Single component, nonsag, Class 100/50 or Single component, nonsag, Class 50. (Designation U-SC)
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Interior joints in vertical surfaces nontraffic surfaces.
1. Joint Locations:
   a. Control and expansion joints on exposed interior wall surfaces.
   b. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
   c. Other joints as indicated.
2. Joint Sealant: Latex. (Designation L-GP)
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

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SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Standard hollow metal doors.
2. Standard hollow metal door frames.
3. Standard hollow metal sidelight frames
4. Standard hollow metal borrowed-light frames.
5. Standard hollow metal fire-rated door and frame assemblies.

B. Related Requirements:
1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.
2. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to SDI A250.8.

1.3 COORDINATION

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

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Submittals shall be started immediately following Contract Notice to Proceed to achieve early frame delivery.

B. Product Data: For each type of product.
1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.

C. Shop Drawings: Include the following:
1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.

3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
1. Provide additional protection to prevent damage to factory-finished units.

B. Frames: Arrange for early separate delivery of hollow metal door frames to be installed in masonry, in concurrence with masonry work.

C. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

D. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ceco Door Products; an Assa Abloy Group company.
2. Curries Company; an Assa Abloy Group company.
3. Pioneer Industries, Inc.
4. Republic Doors and Frames.
5. Steelcraft; an Ingersoll-Rand company.

B. Source Limitations:
1. Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by UL LLC for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
   1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by UL LLC for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.
   1. Physical Performance: Level B according to SDI A250.4.
   2. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches.
      c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
      d. Edge Construction: Model 2, Seamless.
      e. Core: Vertical steel stiffener.
   3. Frames:
      a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
      b. Construction: Full profile back welded.
   4. Exposed Finish: Prime.

A. Frames for Wood Doors: SDI A250.8, Level 2.
   1. Physical Performance: Level B according to SDI A250.4.
   2. Frames:
      a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
      b. Construction: Face welded.
   3. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Maximum-Duty Doors and Frames: SDI A250.8, Level 4.
   1. Physical Performance: Level A according to SDI A250.4.
   2. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches (44.5 mm.)

c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A40 (ZF120) coating.
d. Edge Construction: Model 2, Seamless.
e. Core: Polyurethane or Polyisocyanurate with Vertical steel stiffener.
1) Thermal Performance: Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:
a) The U-factor not to exceed a rating of 0.50 Btu/hr·ft2·° F at a 15 mph wind with 0° F exterior temperature.

3. Frames:
a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A40 coating.
b. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.5 HOLLOW-METAL PANELS

A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.6 FRAME ANCHORS

A. Jamb Anchored.
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.7 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 35 percent.

B. Insulation 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."

C. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

D. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

E. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

F. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

G. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

H. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

I. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

J. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

K. Foamed-in-Place Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free polyurethane insulation, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load, and with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within steel material, with no exposed insulation.

L. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

M. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.8 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
4. Top Edge Closures: Close top edges of doors with seamless flush closures of same material as face sheets.
5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
   2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   3. Grout Guards (if required): Weld guards to frame at back of hardware mortises in frames to be grouted.
   4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
   5. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
         1) Two anchors per jamb up to 60 inches high.
         2) Three anchors per jamb from 60 to 90 inches high.
         3) Four anchors per jamb from 90 to 120 inches high.
         4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
      b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
         1) Three anchors per jamb up to 60 inches high.
         2) Four anchors per jamb from 60 to 90 inches high.
         3) Five anchors per jamb from 90 to 96 inches high.
         4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
7. Terminated Stops: Terminate stops 6 inches above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame. Provide where indicated on the Door Schedule.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

G. Head Reinforcement: Provide minimum of 0.093-inch- thick, steel channel or angle stiffener for opening widths more than 48 inches.

2.9 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
2. Prime prior to application of stops, so that the entire door is coated.

2.10 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

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

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 as required by standards specified.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-rated openings, install frames according to NFPA 80.
      b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      c. Install frames with removable stops located on secure side of opening.
      d. Install door silencers in frames before grouting.
      e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
   a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. Metal-Stud Partitions with Openings Requiring Ratings and Temperature-Rise Limits: Solidly pack mineral-fiber insulation inside frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
6. Exterior walls: Fill space between frames and wall with spray polyurethane foam insulation.
7. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
   a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
   b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
   c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
   d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

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 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition.

Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Touchup of prime coat is specified in Division 09 "Painting" Sections.

END OF SECTION

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Exterior storefront framing.
2. Exterior manual-swing entrance doors and door-frame units.

B. Related Sections:
1. Division 08 Section “Folding Entrance Wall System.”
2. Division 08 Section "Aluminum Framed Curtain Walls" for curtain-wall systems with captured glazing.

1.2 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.3 PERFORMANCE REQUIREMENTS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.

B. Recycled Content of Aluminum Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 35 percent.

C. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:
a. Deflection exceeding specified limits.
b. Thermal stresses transferring to building structure.
c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
d. Glazing-to-glazing contact.
e. Noise or vibration created by wind and by thermal and structural movements.
f. Loosening or weakening of fasteners, attachments, and other components.

g. Sealant failure.
h. Failure of operating units.

D. Delegated Design:
1. Design aluminum-framed storefronts, including comprehensive engineering analysis by a qualified Structural *(Professional)* Engineer, using structural performance requirements and design criteria indicated herein.
2. Be responsible for engineering and design of aluminum entrances and storefront components and materials, fabrication and installation of the aluminum-framed storefront and entrances.

E. Structural Loads:
1. Wind Loads: As indicated on Drawings, and in Wind Design Studies.
2. Seismic Loads: As indicated on Drawings.
3. Interior Loads: Engineer, fabricate and install to withstand a 10 psf. uniform load, and a concentrated load of 250 lbs. applied at 4 feet above the floor with a maximum glass deflection of 1 inch.

F. Deflection of Framing Members:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

G. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

H. Story Drift: Provide aluminum-framed systems that accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As indicated on Drawings.
2. Test Performance: Meet criteria for passing, based on building occupancy type, when tested according to AAMA 501.4 at design displacement and 1.5 times design displacement.

I. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
1. Entrances Doors: With the door closed and locked, when tested in accordance with ASTM E 283:

a. Single Door: At a static pressure of 6.24 psf, air infiltration is not to exceed 0.50 cfm per square foot of door area
b. Double Doors: At a static pressure of 1.65 psf, air infiltration is not to exceed 0.50 cfm per square foot of door area 1.0 cfm per square foot for double doors.

J. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
1. Entrance Doors:
a. Single Door: When tested in accordance with ASTM E 331 at a pressure differential of 3.75 psf, no uncontrolled leakage.
b. Double Doors: When tested in accordance with ASTM E 331 at a pressure differential of 1.75 psf, no uncontrolled leakage.

K. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.

L. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
b. Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).
3. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

M. Condensation Resistance and Thermal Conductance of the system are a combined performance of the aluminum framing and the glass. Verify the required values for the building performance requirements and match with systems which will meet the requirements. Require thermal modeling in Submittals article. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
   1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
   2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
   3. Provide shop drawings sealed and signed by the same State of Maine Licensed Structural (Professional) Engineer that prepared calculations.

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

D. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.5 INFORMATIONAL SUBMITTALS

A. Delegated-Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Detail fabrication and assembly of aluminum-framed systems.
   2. Include design calculations.
   3. Calculations: Copies of anchor design calculations prepared by, signed and sealed by a State of Maine Licensed Structural (Professional) Engineer. Design storefront and anchors in accordance with the performance requirements specified herein and local code.

B. Qualification Data: For qualified Installer.

C. Seismic Qualification Certificates: For aluminum-framed systems**,** accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

D. Welding certificates.

E. Preconstruction Test Reports: For sealant.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

G. Field quality-control reports.

H. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

I. Warranties: Sample of special warranties.

J. Storefront and Entrance Manufacturer's Representatives' inspection report of the storefront and entrance door installation.

1.6 QUALITY ASSURANCE

A. Manufacturer's Responsibilities:
   1. Provide aluminum storefront, entrances and associated items by a firm having undivided responsibility for the entire storefront, entrance and glazing installation, except as otherwise specified herein.
   2. The Storefront and Entrance Manufacturer's Representatives is required to inspect the storefront and entrance door installation to ensure conformance with this Section and to ensure warrantability of the storefront, doors, hardware, paint finish and their installation.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project, with not less than five (5) consecutive years of experience installing storefront and entrances similar that required for the project.

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

D. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings and calculations, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

E. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
   1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

F. Preconstruction Sealant Testing: For structural-sealant-glazed systems, perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will come in contact with sealants and each condition required by aluminum-framed systems.
   1. Test a minimum five samples each of metal, glazing, and other material.
   2. Prepare samples using techniques and primers required for installed systems.
   3. For materials that fail tests, determine corrective measures necessary to prepare each material to ensure compatibility with and adhesion of sealants including, but not limited to, specially formulated primers. After performing

these corrective measures on the minimum number of samples required for each material, retest materials.

G. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 and State of Maine Building Code accessibility requirements.

H. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

I. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

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

K. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Adhesive or cohesive sealant failures.
      e. Water leakage through fixed glazing and framing areas.
      f. Failure of operating components.
   2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Warranty Period: 20 years from date of Substantial Completion.

C. Special Warranty for Weatherseal Sealants: Provide warranty for weatherseal sealants materials and installation as required in Specification Section 07 90 00 Sealants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Subject to compliance with requirements, provide Kawneer 451T storefront system or a comparable product by one of the following:
   1. Arcadia.
   2. EFCO Corporation.
   3. Kawneer North America; an Alcoa company.
   4. Oldcastle Building Envelope (Vistawall).
   5. Wausau Window and Wall Systems.
   6. Vision Systems Architectural Products

2.2 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.

B. Recycled Content of Aluminum Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 35 percent.

C. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Structural Profiles: ASTM B 308/B 308M.
   5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

D. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

E. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction:
   a. Exterior Framing: Thermally broken.
   b. Door frames: Non-thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: As indicated.
4. Framing Member Size: As indicated.

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

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system , fabricated from stainless steel.

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

E. Concealed Flashing: Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer.

F. Receiver channels: Provide thermally broken head receiver channels to provide for deflection of building structure where shown.

G. Sills: Formed or Extruded Aluminum as indicated, 0.090 inches thickness, finish matching framing, with 0.040 inch thickness aluminum backer plates at joints.

H. Jamb Closures: Formed Aluminum 0.090 inches thickness, finish matching framing.

I. Spandrel Back Panels: Aluminum, 0.090 inches thickness, Finish: Match architects sample.

J. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.
1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

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

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

2.5 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
   1. Basis of Design: Wide Stile Glazed entrance doors with square glazing stops, provide one of the following:
      a. Arch Aluminum, Model 75 Entrance.
      b. Efco, D500.
      c. Kawneer, 500 Medium Stile
   2. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
   3. Door Style and Rail Design: As indicated.
      a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches (255 mm) above floor or ground plane.
   4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
      a. Provide nonremovable glazing stops on outside of door.

2.6 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware and entrance door hardware sets indicated in "Entrance Door Hardware Sets" Article for each entrance door, to comply with requirements in this Section.
   1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
   2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
   3. Opening-Force Requirements:
      a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N)to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.
      b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.

B. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
   1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
   2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

C. Butt Hinges: BHMA A156.1, Grade 1.

1. Manufacturer/Product: Stanley FBB199 5” x 4-1/2” x NRP.
2. Nonremovable Pins: Provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
3. Exterior Hinges: Stainless steel, with stainless-steel pin.
4. Quantities:
   a. For doors up to 87 inches (2210 mm) high, provide three hinges per leaf.
   b. For doors more than 87 and up to 120 inches (2210 and up to 3048 mm) high, provide four hinges per leaf.

D. Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
1. Manufacturer/Product: Von Duprin “98” Series.
2. Lever trim on Exit Devices shall match existing lockset trim.
3. Furnish cylinder dogging for all non fire-rated exit devices.

E. Cylinders: BHMA A156.5, Grade 1.
1. Match existing cylinders and keyway.
2. Keying: Master key to existing system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE".

F. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

G. Operating Trim: BHMA A156.6.

H. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
1. Manufacturer/Product: LCN; 4040XP-S-H-Cush x SRI
2. Furnish all Surface closers with “DEL” and “MC”.

I. Weather Stripping: Manufacturer's standard replaceable components.
1. Compression Type: Made of ASTM D 2000 molded neoprene or ASTM D 2287 molded PVC.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

J. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

K. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).
1. Manufacturer/Product: Pemko 2005AT.

L. Rain Drip: Furnish Pemko 346C Rain Drips for all exterior doors.

M. Hardware finishes: Except as noted otherwise, Finish of hardware items shall be as follows:

1. Butts (exterior), Locksets, Exit Devices and OH Stops shall be stainless steel, US32D, (630).
   a. Furnish Antimicrobial Coating for Locksets and Exit Devices.
   b. Push Plates, Kick/Armor Plates and ALL Pulls shall be US32D-316.
2. Closers shall be painted to match other hardware (689) with SRI coating for all Exterior Doors.
3. Threshold shall be Mill Finish with Pemkote (AK).

2.7 ADA POWER OPERATORS

A. ADA Power Operators shall be Horton HD-Swing® Series 4100 Heavy Duty Swing Door Operator Surface Applied. Locate as directed. Units shall be provided with on/off switch for manual operation, electric lock delay and hold open delay. Interface with Electrified Hardware. Operators shall be furnished and installed by factory trained, AAADM Certified technicians.

2.8 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

2.9 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   4. Physical and thermal isolation of glazing from framing members.
   5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   6. Provisions for field replacement of glazing from exterior.
   7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Doors:

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.
3. Reinforce aluminum doors with steel as follows:
   a. Tie bars: Horizontal at top and bottom rails, 3/8 inch diameter.
   b. Hinge attachment: Continuous minimum 1 ¼" x 1/4" steel bar.
   c. Closer: Continuous 3/16 to receive closer attachment screws.
   d. Factory weld all four corners of the door in concealed locations.

F. Entrance Door Frames: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Cut, drill, and tap for factory-installed hardware before finishing components.
1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
3. Reinforce aluminum entrance door frames and subframes with steel as follows:
   a. Continuous minimum 1 1/4 x 1 1/4 x 3/16-inch steel angle full height of door, with minimum 4 x 6 x 3/16-inch base plate for installing hardware. Cut, drill, and tap for factory-installed hardware before finishing components.
   b. Closer: Continuous 1/2 x 2-inches.
   c. Rim exit device strike: 1 1/4 x 7/16 x 4-inches.

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

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

2.10 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF or FEVE resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 INSTALLATION

A. General:
1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

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

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

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

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install fiberglass insulation solid between storefront members and adjacent construction and in voids within the system and where shown on the Drawings. Compress fiberglass to 50 percent or less of original thickness.

I. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment:
   a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
   b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.4 FIELD QUALITY CONTROL

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

B. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

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

D. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
   1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 75 mm (3 inches) from the latch, measured to the leading door edge.

3.6 ENTRANCE DOOR HARDWARE SCHEDULE

A. Group 1 (Stairway doors)
   1. Butts
   2. 1 Exit Devices VON CD98 Passage (TL)
   3. 1 Closer
   4. Gasketing and sweep By Door Manufacturer
   5. 1 Threshold

B. Group 2 (Elevator Lobby door)
   1. Butts
   2. 2 Exit Devices VON CD9847 Classroom (L)
   3. 1 ADA Power Operator (In place of 2nd Closer, Owner to confirm)
   4. 2 Closer (Provide 1 closer if Power Operator is provided)
   5. Gasketing and sweep By Door Manufacturer
   6. 1 Threshold

END OF SECTION

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SECTION 08 44 13

GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Section includes glazed aluminum curtain walls with glazing retained mechanically with gaskets on four sides.
2. Mockup of Aluminum Framed Curtain Wall.
3. Structural Design and Calculations for Glazed Aluminum Curtain Wall.

B. Related Sections:
1. Division 08 Section "Aluminum-Framed Entrances and Storefronts" for door and frame assemblies installed in glazed aluminum curtain-wall assemblies.

1.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing manufacturer's standard of structural-sealant-glazed curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Structural-sealant-glazed curtain walls shall withstand movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

B. Delegated Design:
1. Design structural-sealant glazed curtain walls, including comprehensive engineering analysis by a qualified Structural *(Professional)* Engineer, using structural performance requirements and design criteria indicated herein.
2. The Contractor is responsible for the engineering and design of all components and materials, as well as the installation of the Structural-Sealant Glazed Curtain Wall System.

C. Structural Loads:
1. Wind Loads: As indicated on Drawings.
2. Periodic Maintenance-Equipment Loads: As indicated on Drawings.
3. Seismic Design Data: As indicated on the Structural Drawings.
4. Copings: See Section 07 62 00 Sheet Metal Flashing and Trim for coping design requirements.

D. Structural-Test Performance: Provide structural-sealant-glazed curtain walls tested according to ASTM E 330 as follows:
   1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Deflection of Framing Members: At design wind pressure, as follows:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
   2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.
      a. Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.
   3. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to 2 times the length of cantilevered member divided by 175.

F. Seismic Performance: Structural-sealant-glazed curtain walls shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
   1. Component Importance Factor is 1.0.

G. Story Drift: Accommodate design displacement of adjacent stories indicated.
   1. Design Displacement: As indicated on Drawings, if not indicated, request data from Architect.
   2. Test Performance: Meets criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.

H. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. (480 Pa).

I. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. (480 Pa).
   1. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.

J. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
   2. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).

3. Test Performance: No buckling, stress on glass, sealant failure, or excess stress on framing, anchors, and fasteners and no reduction of performance when tested according to AAMA 501.5.

K. Energy Performance: Structural-sealant-glazed curtain walls shall have energy performance ratings according to NFRC.
1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45, as determined according to NFRC 100.
2. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft..
3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified CR rating of no less than 50 as determined according to NFRC 500.
4. Energy code requires NFRC 100 certification of the fenestration as simulated under the following conditions:
5. Exterior T = 0.4-deg F.
6. Interior T = 69.8-deg F.
7. V wind = 12.3 mph
8. Condensation Resistance analysis occurs at 30% RH, 50% RH, and 70% RH.

L. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.4 as determined according to NFRC 200.

M. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

N. Structural-Sealant Joints:
1. Designed to produce tensile or shear stress of less than 20 psi (138 kPa).
2. Design reviewed and approved by structural-sealant manufacturer.

O. Anchors and Connections:
1. Anchors, connections and assemblies connecting the curtain wall components and associated fabrications to the supporting construction are shown on the Drawings as suggested locations for the curtain wall manufacturer/installer's information. The curtain wall manufacturer/ installer is responsible for the structural design of the connections and anchors, including all connecting hardware, accessories and reinforcing necessary for fabrication, and installation of the curtain wall system and associated fabrications.
2. The curtain wall manufacturer is to notify the Architect in writing prior to the submittal of shop drawings of any changes in the proposed locations of connections and anchors.
3. The Architect's review of shop drawings is not to be construed as removing responsibility from the curtain wall manufacturer/installer for structural failures related to design, fabrication, installation and fabrication service.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   1. Interior Paints and Coatings applied on site.

B. Shop Drawings: For structural-sealant-glazed curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each vertical-to-horizontal intersection of structural-sealant-glazed curtain walls, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.
   3. Provide shop drawings with seal and signature of Structural (Professional) Engineer currently registered in the State of Maine. Provide the same engineer who prepares and signs the design calculations.
   4. Include shop drawings for mockups.

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

D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   3. Expansion provisions.
   4. Glazing.
   5. Flashing and drainage.

1.4 INFORMATIONAL SUBMITTALS

A. Delegated-Design Submittal: For structural-sealant-glazed curtain walls 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. Design Calculations: Submit structural calculations prepared by a Structural (Professional) Engineer licensed in the State of Maine, showing compliance with the specified performance criteria.

B. Qualification Data: For qualified Installer preconstruction testing agency and testing agency.

C. Evaluation Reports: For Aluminum Framed Curtain Wall: ICC report.

D. Seismic Qualification Certificates: For structural-sealant-glazed curtain walls, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

E. Welding certificates.

F. Energy-Performance Certificates: For structural-sealant-glazed curtain walls, accessories, and components, from manufacturer.
   1. Basis for Certification: NFRC-certified energy-performance values for each structural-sealant-glazed curtain wall.

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

H. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.

I. Maintenance Data: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C 1401 recommendations for postinstallation-phase quality-control program.

J. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

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

B. Fabricator/Installer Requirements: Provide curtain wall systems and associated items by a firm having undivided responsibility for the entire curtain wall system design, fabrication and installation as shown on the Drawings and specified herein as evidenced by not less than five (5) years experience in fabricating and installing the proposed curtain wall.

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

D. Testing: Where manufacturer's standard curtain wall system complies with performance and test requirements and has been tested by an independent laboratory in accordance with the specified tests, provide test reports and certification by manufacturer showing compliance with such tests. Test reports shall not be older than five (5) years. When no tests exist, perform required tests through a recognized independent testing laboratory or agency and provide certified test report results.

E. Design Calculations: The curtain wall fabricator/installer shall submit design calculations to substantiate performance requirements specified herein, prepared by, signed and sealed by a Structural (Professional) Engineer licensed in the State of Maine. Calculations will not be reviewed by the Architect but are submitted for information purposes only and as evidence that the curtain wall fabricator/installer has engaged a structural engineer to provide them. The curtain wall fabricator/installer shall bear full responsibility for engineering the curtain wall design to comply performance requirements. Test reports are not an acceptable substitute for design calculations.

F. Product Options: Information on Drawings and in the Specifications establishes requirements for system's aesthetic effects and performance characteristics.

Aesthetic effects are indicated on the Drawings by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines and relationships to one another and to adjoining construction. Performance characteristics are indicated by criteria specified herein subject to verification as specified.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's written approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect in accordance with Section 01 60 00 "Product Requirements" for review prior to submittal of shop drawings.

G. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of structural-sealant-glazed curtain walls.

H. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

I. Post Installed Anchors: Meet the requirements of Section 03 15 10 "Post Installed Anchors" including Field Quality Control

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

K. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

L. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

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

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.
   b. Noise or vibration created by wind and thermal and structural movements.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   d. Water penetration through fixed glazing and framing areas.

e. Failure of operating components.
f. Sealant (including structural silicone) loss of adhesion, loss of cohesion, cracking or discoloration.

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

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: 20 years from date of Substantial Completion.

C. Special Warranty for Weatherseal Sealants: Provide warranty for weatherseal sealants materials and installation as required in Specification Section 07 90 00 Sealants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer 1600, or comparable product by one of the following:
1. Arcadia.
2. EFCO Corporation.
3. Kawneer North America; an Alcoa company.
4. Oldcastle Building Envelope (Vistawall).
5. Wausau Window and Wall Systems.
6. Vision Systems Architectural Products

2.2 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

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

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

2.3 FRAMING

A. Framing Members: Manufacturer's standard formed- or extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.
   3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system , fabricated from Series 300 stainless steel.

C. Anchors: Three-way adjustable anchors, with minimum adjustment of 1 inch (25.4 mm), that accommodate fabrication and installation tolerances in material and finish and are compatible with adjoining materials and recommended by manufacturer.
   1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

D. Concealed Flashing: Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer.

E. Framing Sealants: Manufacturer's standard sealants.

F. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.

G. Exterior Trim Covers (Pressure plate cover cap): Manufacturer’s standard or custom extruded aluminum snap on covers for glazing pressure plates.
   1. 3/4 to 7/8 inch depth (to face of glass) rectangular cover where indicated.
   2. Closures for locations where open end of cover would be exposed: Aluminum.
   3. Finish: Match framing unless otherwise indicated.

H. Extruded Aluminum Interior Stools: 0.125 inch thickness, finished to match curtain wall.
   1. Electrical raceway, where indicated.

I. Aluminum Vertical Fins and Copings and Formed Covers: Metal Composite Material, extruded and formed aluminum as indicated,
   1. Aluminum-Faced Composite Material: Formed with 0.020-inch- (0.50-mm-) thick, anodized aluminum sheet facings.
      a. Thickness: 0.157 inch (4 mm).
      b. Core: Fire retardant.
      c. Finish: Match curtain wall finishes as indicated on the Drawings.
   2. Aluminum Thickness: 0.125 inch thickness.

a. Finish: Match curtain wall finishes as indicated on the Drawings.

J. Head Seal: Provide deflection head seal consisting of resilient Pre-cured silicone membrane inserts in aluminum receivers, mechanically anchored to head frame and to construction above where indicated.
1. Membrane Thickness: 0.125 inches.
2. Silicone sealant: Manufacturer's standard silicone sealants.

K. Formed Aluminum sills: 0.125 inch thickness, finished to match curtain wall.

L. Stainless Steel Safety railing: Provide stainless steel safety railing in locations indicated, attach between mullions where indicated.

M. Shadow box back pan: Provide 0.090-inch thickness back pans shadow box spandrel areas, color: As selected by Architect from Manufacturer’s standards.

2.4 GLAZING

A. Glazing: Comply with Division 08 Section "Glazing."

B. Glazing Gaskets, Spacers, Setting Blocks, Sealant Backings, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types compatible with sealants and suitable for joint movement and assembly performance requirements.

C. Glazing Sealants: For glazed aluminum curtain walls, as recommended by manufacturer for joint type.
1. Structural Sealant: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in curtain-wall assembly indicated.
a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Color: As selected by Architect from manufacturer's full range of colors.

2. Weatherseal Sealant: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.
a. Color: Matching structural sealant.

2.5 OPERABLE UNITS

A. Doors: Comply with Division 08 Section "Aluminum-Framed Entrances and Storefronts."

2.6 ACCESSORY MATERIALS

A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

B. Insulation: See Section 07 21 00 thermal insulation.

C. Sill Splice Joint Seal: Pre-cured silicone membrane.
   1. Thickness: .0625 inches.
   2. Silicone adhesive: Manufacturer's standard silicone sealants.

D. Sill Liner Flashing:
   1. Self-Adhering, High-Temperature Sheet: 30 to 40 mils (0.76 to 1.0 mm) thick minimum, consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
      a. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
      b. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.

E. Cleaning Agent and Cloth: As recommended by structural-sealant manufacturer.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Physical and thermal isolation of glazing from framing members.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
   6. Provisions for field replacement of glazing from exterior. Include accommodations for using temporary support device (dutchman) to retain glazing in place while sealant cures.
   7. Provisions for safety railings mounted on interior face of mullions or between mullions at interior as indicated, in locations indicated.
   8. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within structural-sealant-glazed curtain wall to exterior.

D. Factory-Assembled Frame Units:
   1. Rigidly secure nonmovement joints.
   2. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
   3. Preparation includes, but is not limited to, cleaning and priming surfaces.
   4. Seal joints watertight unless otherwise indicated.
   5. Install glazing to comply with requirements in Division 08 Section "Glazing."

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

F. Unitized Construction: Curtainwall systems are to be designed to be placed onto the Building in pre-glazed units.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Finish for Interior Material: Where indicated provide Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   1. Color and Gloss: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmoving joints.
   5. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and impediments to movement of joints.
   6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

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

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within structural-sealant-glazed curtain walls to exterior.

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

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

F. Install weatherseal sealant according to Division 07 Section "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

G. Install fiberglass insulation solid in voids between and within curtain members, behind solid panels, where curtain wall abuts adjacent construction, in shim spaces and where shown on the Drawings. Compress fiberglass to 50 percent of less of original thickness.

H. Anchoring and Fastening:
1. Install and anchor components in accordance with the final reviewed shop drawings.
2. Anchor components with concealed fasteners and anchors. Exposed anchors and fasteners are not acceptable unless shown on the submitted shop drawings and approved by the Architect.
3. Wood blocking and shims are not acceptable for attachment or anchoring curtain wall components, use only manufacturer approved shims, clip angles and attachment devices.

I. Extend vertical mullions to supporting structure as shown on the Drawings. Provide slotted connections anchored to the supporting structure and vertical mullion members which allows for a maximum of 1-1/2 inches of deflection of the supporting structure, unless additional deflection of the structure is indicated, or required to accommodate.

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install to comply with the following nonaccumulating maximum tolerances:
1. Plumb: 1/8 inch in 10 feet (3 mm in 3 m); 1/4 inch in 40 feet (6 mm in 12 m).
2. Level: 1/8 inch in 20 feet (3 mm in 6 m); 1/4 inch in 40 feet (6 mm in 12 m).
3. Alignment:
   a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
   b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
   c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
4. Location: Limit variation from plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/2 inch (12.7 mm) over total length.

3.4 FIELD QUALITY CONTROL

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

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

END OF SECTION

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SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Mechanical door hardware for the following:
a. Swinging doors.
b. Swinging gates.

B. Related Sections:
1. Section 08 41 13 "Aluminum Framed Entrances and Storefronts" for entrance door hardware.

1.2 PREINSTALLATION MEETINGS

A. Keying Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For electrified door hardware.
1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.

C. Samples: For each exposed product in each finish specified.

D. Door hardware schedule.

E. Keying schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedule.
2. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC).

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
a. Exit Devices: Two years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

C. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the DOJ's "2010 ADA Standards for Accessible Design" the DOT's "ADA Standards for Transportation Facilities" ICC A117.1.

2.2 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.
1. Door hardware is scheduled in Part 3.

2.3 HINGES

A. Butt Hinges: BHMA A156.1, Grade 1.
   1. Manufacturer/Product: Stanley FBB199 5” x 4-1/2” x NRP.
   2. Nonremovable Pins: Provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
   3. Exterior Hinges: Stainless steel, with stainless-steel pin.
   4. Quantities:
      a. For doors up to 87 inches (2210 mm) high, provide three hinges per leaf.
      b. For doors more than 87 and up to 120 inches (2210 and up to 3048 mm) high, provide four hinges per leaf.

B. Spring Hinges:
   1. Manufacturer/Product: Stanley 521 Round Corner Spring Hinges - Stainless Steel.
   2. 4", Stainless Steel.
   3. Stock # S849-760
   4. Adjustable closing speed.

2.4 EXIT DEVICES

A. Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
   1. Manufacturer/Product: Von Duprin “98” Series.
   2. Lever trim on Exit Devices shall match existing lockset trim.
   3. Furnish cylinder dogging for all non fire-rated exit devices.

2.5 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lockset Design: Schlage, unless existing hardware is other Manufacturer. Match existing hardware manufacturer.
   1. Bored Locks: Grade 1, Series 4000.
   2. Lever Style: Match existing lockset levers.

C. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
   1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
   2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
   3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
   4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

2.6 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

A. Automatic Flush Bolts: BHMA A156.3, Type 25; minimum 3/4-inch (19-mm) throw; with dust-proof strikes; designed for mortising into door edge. Include wear plates.
1. Manufacturers/Product: Ives; FB32 Top Bolt with Auxiliary Fire Latch

2.7 LOCK CYLINDERS

A. Cylinders: BHMA A156.5, Grade 1.
1. Match existing cylinders and keyway.

2.8 KEYING

A. Keying: Master key to existing system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE".

B. Keys: Nickel silver.
1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
a. Notation: "DO NOT DUPLICATE."

2.9 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel unless otherwise indicated.

2.10 ACCESSORIES FOR PAIRS OF DOORS

A. Automatic Flush Bolts and Coordinators: Ives or Rockwood.
1. Conform to ANSI/BHMA A156.3. Coordinators shall be continuous across door header, complete with filler plates and brackets as required.

2.11 SURFACE CLOSERS

A. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
1. Manufacturer/Product:
a. Non-fire rated doors: LCN; 4040XP-S-H-Cush x SRI
b. Fire-rated Doors: LCN; 4040XP-S-Cush x SRI
2. Furnish all Surface closers with “DEL” and “MC”.

2.12 DOOR GASKETING

A. Gasketing and Seals: Conform to ANSI/BHMA A165.22
1. Head and Jambs: Smoke seals equal to Pemko S88, installed per manufacturer's printed instructions.
2. Meeting Stile at Pairs: Overlapping astragal seals equal to Pemko 375R or two Pemko 3035 astragal seals as appropriate. Material shall be bronze or aluminum to match balance of hardware specified.

2.13 WEATHER STRIPPING

A. Door Sweep: Pemko 315_N Door Bottom Sweep.

2.14 THRESHOLDS

A. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).
   1. Manufacturer/Product: Pemko 2005AT.

2.15 STOPS

A. Door Stops: ANSI/BHMA A156.16. Furnish wall stops equal to Rockwood 403 wherever trim strikes wall. Where wall stops are not suitable, furnish floor stops equal to Rockwood 441CU (with removable riser).

2.16 SECURITY HARDWARE

A. LAS - Local Alarm Sounder:
   1. DETEX Model# EAX-4200
      a. Stand Alone with Key override.
   2. DETEX EAX-411SK
      a. without key override.

B. Door Contact:
   1. SENTROL 1078 - recessed model
   2. SENTROL 2500 Series – surface mount

2.17 FINISHES

A. Hardware finishes: Except as noted otherwise, Finish of hardware items shall be as follows:
   1. Butts (exterior), Locksets, Exit Devices and OH Stops shall be stainless steel, US32D, (630).
      a. Furnish Antimicrobial Coating for Locksets and Exit Devices.
      b. Push Plates, Kick/Armor Plates and ALL Pulls shall be US32D-316.
   2. Closers shall be painted to match other hardware (689) with SRI coating for all Exterior Doors.
   3. Threshold shall be Mill Finish with Pemkote (AK).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
   1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
   1. Replace construction cores with permanent cores as directed by Owner.

E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."

F. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
   1. Do not notch perimeter gasketing to install other surface-applied hardware.

G. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

H. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.2 ADJUSTING

A. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.3 DOOR HARDWARE SCHEDULE

A. Group 11: Fire rated pair.
   1. Butts
   2. 1 Lockset: Schlage; Lockset ND80PD
   3. 2 Closer: LCN; Surface closer 4040XP-S-Cush x SRI
   4. 1 Automatic flush bolts: Ives;
   5. 1 Coordinator: Ives; FB32
   6. 1 set Gasketing
   7. 2 Bottom Sweep:
   8. 1 Threshold

B. Group 12: Non-fire rated pair.
   1. Butts
   2. 1 Lockset: Lockset ND80PD
   3. 2 Closer: LCN; Surface closer 4040XP-S-H-Cush x SRI
   4. 1 Automatic flush bolts.
   5. 1 Coordinator: Ives; FB32
   6. 1 set Weatherstripping
   7. 2 Bottom Sweep:
   8. 1 Threshold

C. Group 13: Gates.
   1. Spring hinges
   2. 1 Exit Devices VON CD98 Classroom (L)
   3. 1 Local Alarm Sounder.
   4. 1 Door Contact.
   5. 1 Stop.

END OF SECTION

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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. Storefront framing.
   5. Glazed entrances.
   6. Interior borrowed lites.

B. elated Sections:
   1. Division 01 Section “Alternates” for alternates.
   2. Division 07 Section "Building Thermal Insulation" for insulation behind spandrel glass.
   3. Division 08 Section "Structural-Sealant-Glazed Curtain Walls" for curtain wall framing.

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.3 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design:
   1. Glass thicknesses and heat treatment indicated are minimums listed for detailing only.
   2. Design glazing, including comprehensive analysis, using performance requirements, design criteria and industry standards indicated herein. Confirm glass thicknesses by analyzing Project loads and in-service conditions.

3. Manufacturer's Engineering Analysis: For exterior glazing, the glass manufacturer shall perform wind load and thermal stress analyses and select glass thickness strength (including heat treatment) required to demonstrate compliance of glass with performance requirements.

C. Design glass according to ASTM E 1300 by a qualified professional engineer, using the following design criteria:
   1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
      a. Wind Design Data: As indicated on Drawings and in the Cladding Wind Load Study.
      b. Seismic Design Data: As indicated on Drawings.
   2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
   3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less and sloped glass (including glass canopies) not to exceed 1/2 inch (13mm) at center point.
   4. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.
   5. Heat Treatment for Exterior Lites: Provide Heat Strengthened exterior lites, unless Fully Tempered or Laminated Glass are indicated.
   6. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
   7. Tempered Glass: Unless otherwise specified tempered glass intended for use on the project shall be heat soaked tested in accordance with prEN 14179-1 "Heat Soaked Thermally Toughened Soda Lime Silicate Safety Glass" for a minimum of 2 hours at not less than 280^{O}C. in order to minimize the occurrence of nickel sulfide crystals. This process shall be strictly controlled and carried out paying particular attention to temperature limits and duration of treatment for each phase.
   8. Safety Glazing: For glass panels that are accessible to pedestrians (and not protected by an 18 in. high obstruction) provide safety glazing (either laminated or fully tempered glass)

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.

4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

1.4 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

B. Comply with requirements specified in Sections "Glazed Aluminum Curtain Walls", "Aluminum Framed Entrances and Storefronts", for field hose testing of glass panels installed in assemblies erected in the work of those sections.

1.5 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.

C. Glazing Accessory Samples: For gaskets sealants and colored spacers, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Delegated-Design Submittal: For glass 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. Wind Load and Thermal Stress Analyses: Copies of manufacturer’s wind load and thermal stress analyses.

B. Qualification Data: For installers manufacturers of insulating-glass units with sputter-coated, low-e coatings glass testing agency and sealant testing agency.

C. Product Certificates: For glass and glazing products, from manufacturer.
   1. Provide certification from glass producer/fabricator that glass producer/fabricator has reviewed all glazing details and thicknesses and finds same suitable for the purpose intended in accordance with these specifications. This shall include a written wind load and thermal stress analysis showing a probability of failure of no greater than eight (8) lites per thousand at the design and test loads and local climatic thermal conditions.
   2. Certification, Tempered Glass Testing: Submit certification that tempered glass intended for use on the project has been heat soaked tested in accordance with prEN 14179-1 “Heat Soaked Thermally Toughened Soda Lime Silicate Safety Glass”.
   3. Certification, Insulating Glass Testing: Submit certification that the insulating glass units have been granted the IGCC classification "CBA" or Associated Laboratories Inc. Classification "Level A".

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for tinted glass coated glass insulating glass glazing sealants and glazing gaskets.
   1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

E. Preconstruction adhesion and compatibility test report.

F. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

E. Source Limitations for Glass: Obtain ultraclear float glass, tinted float glass, coated float glass, laminated glass and insulating glass from single source from single manufacturer for each glass type.

F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

G. 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. Glass Association of North America (GANA) Publications:
      a. "Laminated Glazing Reference Manual".
      b. "Glazing Manual."
      c. "Sealant Manual".
   2. Insulating Glass Manufacturer's Alliance IGMA Publications
      a. Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
   3. Consumer Product Safety Commission (CPSC): Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of CPSC 16 CFR Part 1201 for category II materials. Subject to compliance with requirements and local authorities having jurisdiction, provide safety glass with a removable certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.

H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

I. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F (250 deg C), and the fire-resistance rating in minutes.

J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

K. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. See Section 01 45 34 "Mockups For Exterior Wall Systems."

L. Laboratory testing shall be performed on mockups according to requirements in Specification Section 01 45 36 "Performance Testing for Exterior Wall and Window Systems."
   1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

M. Preinstallation Conference: Conduct conference at Project site.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Review temporary protection requirements for glazing during and after installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. Warranty Period: 10 years from date of Substantial Completion.

D. Special Warranty, Sealant: Provide a written warranty, agreeing to repair or replace silicone sealant compounds which have failed to provide airtight and watertight joints for any reason, or which appear to have failed in adhesion, cohesion, abrasion-resistance, migration-resistance, stain-resistance, general durability or other form of apparent deterioration (excluding inherent qualities and limitations clearly specified in the manufacturer's data which was submitted).
   1. Period of warranty shall be 20 years, and warranty shall be signed by the Manufacturer, the installer and the Contractor. Comply with these Specifications for repair or replacement of work.

PART 2 - PRODUCTS

2.1 GENERAL

2.2 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum, selected for detailing purposes only. Confirm glass thickness and heat treatment necessary for glass unit sizes required against performance requirements for exterior glazing and in-service conditions. Provide glass lites in thicknesses and heat treatment as needed to comply with requirements indicated.
   1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
   2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

B. Strength:
   1. Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article.
   2. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article.
   3. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

2.3 GLASS PRODUCTS

A. Basis of Design for Glass: Subject to compliance with the requirements, provide Glass by PPG, including C2C Certification, or a comparable product by another listed manufacturer.

B. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated. Provide one of the following:
   1. AFGD, clear float glass.
   2. Guardian, clear glass.
   3. Pilkington Libbey-Owens-Ford (LOF), clear glass
   4. PPG Industries, clear glass.
   5. Viracon, clear glass.
   6. Zeledyne, clear glass.

C. Ultraclear Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I, complying with other requirements specified and with visible light transmission not less than 91 percent.
   1. Basis of Design Products: Subject to compliance with requirements, Pilkington Optiwhite, or a comparable product by one of the following:
      a. AFG Industries, Inc.; Krystal Klear.
      b. Guardian Industries Corp.; Ultrawhite.
      c. Pilkington North America; Optiwhite.
      d. PPG Industries, Inc.; Starphire.
      e. Saint-Gobain; SGG Diamant.

D. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.

E. Clear Low-Emissivity (Low E) Glass: Provide low "e" glass complying with ASTM C 1376 pyrolytically (magnetic sputter vacuum) coated low-emissivity glass, and resulting in a stable, uniform, nearly invisible coating which imparts average maintained insulating performance of at least R = 2.5. tempered in doors and adjacent lights and heat strengthened where shown on Drawings or required by codes.
   1. Edge Deletions: Provide accurate and straight edge deletions of coatings at areas of insulating glass assemblies where Low “E” coatings, metallic coating or other decorative coatings are applied to surfaces scheduled to be in contact with the primary seal of insulating glass units.
      a. Tolerance for edge deletion placement: Plus, or minus 1/32 inch.
   2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated in the Schedule, or comparable product by one of the listed manufacturers.

F. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
   2. For uncoated glass, comply with requirements for Condition A.
   3. For coated vision glass, comply with requirements for Condition C (other coated glass).

G. Uncoated Tinted Float Glass: Class 2, complying with other requirements specified.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated in the Schedule, or comparable product by one of the listed manufacturers.

H. Ceramic-Coated Vision Glass: Heat-treated float glass, Condition C; with ceramic enamel applied by silk-screened process; complying with Specification No. 95-1-31 in GANA's Tempering Division's "Engineering Standards Manual" and with other requirements specified.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated in the Schedule, or comparable product by one of the listed manufacturers.
      a. Standard patterns.
      b. Custom patterns as indicated.
      c. Colors: As selected from Industry Standard colors.

I. Ceramic-Coated Spandrel Glass: ASTM C 1048, Type I, Condition B, Quality-Q3.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated in the Schedule, or comparable product by one of the listed manufacturers.
      a. Colors: As selected from Industry Standard colors.

2.4 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
   1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
   2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
   3. Interlayer Color: Clear unless otherwise indicated.
   4. Minimum 0.030 inch thick clear polyvinyl butyral (PVB) interlayer, thickness as determined by the glass manufacturer to comply with the specified performance requirements, where shown on Drawings, provide interlayer by one of the following:
      a. E. I. duPont de Nemours & Co., Inc., Butacite.
      b. PPG, Watchguard.
      c. Solutia Inc., Saflex.

B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated-Glass Types" Article.

2.5 INSULATING GLASS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Pilkington LOF.
   2. PPG.
   3. Guardian.
   4. Viracon.

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
   1. Sealing System: Dual edge-sealed, with manufacturer's standard primary and secondary seals which are certified for the insulating glass seal classification "CBA" by the Insulating Glass Certification Council (IGCC) or classification "Level A" by the Associated Laboratories, Inc. (ALI) Certification Program when tested in accordance with ASTM E2188, ASTM E2189, ASTM E773 and ASTM E774 (as sponsored by the Sealed Insulating Glass Manufacturer's Association).
   2. Spacer: Polypropylene covered or painted stainless steel in color selected by Architect.
   3. Desiccant: Molecular sieve or silica gel, or blend of both.

C. Fabrication: Fabricate units at factory with sheets of glass hermetically sealed at edges with a permanent elastomeric sealant. Dehydrate entrapped air. Glass lights with bent, welded or fused corners, splices or joints shall be separated by desiccant filled aluminum spacer marked with the appropriate classification, listed manufacturer and approval marked on the spacer.
   1. Low E Coating Edge Deletion in Insulating Glass Units: Provide accurate and straight edge deletions of coatings at areas of insulating glass assemblies where Low "E" coatings, metallic coating or other decorative coatings are applied to surfaces scheduled to be in contact with the primary seal of insulating glass units.

D. Glass: Comply with applicable requirements in "Glass Products" Article and in "Laminated Glass" Article as indicated by designations in "Insulating-Glass Types" Article and in "Insulating-Laminated-Glass Types" Article.

E. Muntins located between insulating glass lites: Coordinate with Section 08 51 13 "Aluminum Windows."

2.6 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.

B. Laminated Ceramic Glazing: Laminated glass made from 2 plies of clear, ceramic flat glass; 5/16-inch (8-mm) total nominal thickness; complying with testing requirements in 16 CFR 1201 for Category II materials, and with premium polished surfaces.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite Plus.
      b. Schott North America, Inc.; Laminated Pyran Crystal.
      c. Vetrotech Saint-Gobain; SGG Keralite FR-L.

C. Fire-Protection-Rated Laminated Glass: 5/16-inch- (8-mm-) thick, fire-protection-rated laminated glass, complying with testing requirements in 16 CFR 1201 for Category II materials.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Oldcastle Glass, Inc.; Pyroguard.

2.7 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
   1. EPDM complying with ASTM C 864.
   2. Silicone complying with ASTM C 1115.
   3. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
   1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.8 GLAZING SEALANTS

A. General:
   1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
   4. Use sealants that meet 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."

B. Structural Sealant: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in curtain-wall assembly indicated.
   1. Color: As selected by Architect from manufacturer's full range of colors.

C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 1199 Silicone Glazing Sealant.
      b. GE Advanced Materials - Silicones; SCS2800 SilGlaze* II.
   2. Applications: Glazing.

A. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 790.
      b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
   2. Applications: Weatherseal.

B. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.9 GLAZING TAPES

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

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   1. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.10 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 contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

H. Recessed Extruded Aluminum Glazing Channels: Aluminum extrusions complying with ASTM B 221, 6063-T5 alloy and temper G.S. 10A-T5, with clear anodized finish with manufacturer’s standard continuous roll-in glazing gaskets retained in extrusion races, as manufactured by C.R. Laurence Company, or other as approved by Architect.

2.11 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Where glass is indicated to be butt joined with sealant, vlean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce satin finished, flat, square edges with slight chamfers at junctions of edges and faces.

C. Where edges of glass is indicated to be exposed in the finish work, Grind smooth and polish exposed glass edges and corners and slightly ease arrises and corners.

2.12 MONOLITHIC-GLASS TYPES

A. Glass Type **GL1:** Clear float glass.
1. Thickness: 6.0 mm minimum.

B. Glass Type **GL1T:** Clear float glass fully tempered float glass.
1. Thickness: 6.0 mm minimum.
2. Provide safety glazing labeling.

2.13 LAMINATED GLASS TYPES

A. Glass Type **GL1L**: Clear laminated float glass.
1. Overall Thickness: 5/16-inches.
2. Thickness of each lite: 1/8-inch.
3. Interlayer thickness: 0.060 Inches.
4. Provide safety glazing labeling.

2.14 INSULATING-GLASS TYPES

A. Glass Type **GL-11**: Clear insulating glass matching existing glass.
1. Overall Unit Thickness: 1 inch (25 mm).
2. Outdoor Lite: Heat-strengthened clear float glass.
3. Interspace Content: Argon.
4. Indoor Lite: Heat-strengthened clear float glass.
5. Low-E Coating: Match existing if there is one.
a. Location: 2nd surface.

B. FIRE-PROTECTION-RATED GLAZING TYPES

C. Glass Type **GL-20**: 20-minute fire-rated glazing; Fire-Protection-Rated Laminated Glass.
1. Provide safety glazing labeling.
2. Provide fire protected glazing labeling.
3. Fire rating: 20 minutes.

D. Glass Type **GL-21**: 45-minute, 60-minute, 90-minute fire-rated glazing; laminated ceramic glazing.
1. Provide safety glazing labeling.
2. Provide fire protected glazing labeling.

3. Fire rating: Match opening requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

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 joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
   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 (3-mm) 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 where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing 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 right before each glazing unit is installed.

F. 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.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

D. At glazing without vertical frames, seal glazing units to each other and to the perimeter with structural glazing sealant. Tool both sides smooth. Use clear sealant, unless otherwise indicated.

3.7 CLEANING AND PROTECTION

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 substances immediately as recommended in writing 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 buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction 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 in writing by glass manufacturer.

END OF SECTION

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SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.
3. Equipment backing plates.
4. Roller-shade attachment plates.

B. Related Requirements:
1. Section 05 40 00 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.
2. Section 07 21 00 "Thermal Insulation" for insulation installed within studs.
3. Section 07 84 43 "Fire-Resistive Joint Systems" for head-of-wall joint systems installed with non-load-bearing steel framing.
4. Section 09 29 00 "Gypsum Board".
5. Section 09 21 16 "Gypsum Board Shaft Wall Assemblies" for non-load-bearing metal shaft-wall framing, gypsum panels, and other components of shaft-wall assemblies.

1.2 ACTION SUBMITTALS

A. Coordination: Submit related product data/shop drawings, specified in another Section simultaneously for approval.
1. Gypsum board product data for gypsum board to be used as part of non-structural metal framing.
2. Gypsum board shaft wall product data for shaft walls related to non-structural metal framing.

B. Product Data: Submit manufacturer’s product data, typical installation details and other data for each type of product listed to show compliance with the requirements.

1.3 INFORMATION SUBMITTALS

A. Span and Deflection Design Criteria: Provide height to load deflection charts showing studs supplied conform to deflection limit scheduled and allowed per ASTM C 754.
1. Mark on chart(s) showing all major partitions scheduled conformance with criteria.

2. Submit manufacturer's certification of stud size, thickness, and spacing complying with performance requirements and selections made by architect are correct for application shown.

B. Evaluation Reports: For firestop tracks, from ICC-ES.

C. Mill Certificates: Signed by manufacturers of steel certifying that products furnished comply with requirements.

1.4 QUALITY ASSURANCE

A. Installer's Qualifications: Firm and individuals with a minimum of 5 consecutive years experience in the installation of specified products on projects similar in material, design, complexity and extent to this Project, and whose work has resulted in applications with a record of successful in-service performance.

B. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer acceptable to the gypsum board manufacturer.

1.5 HANDLING

A. Delivery: Protect materials from excessive moisture in shipment, storage, and handling.

B. Storage: Store off ground, either in a dry, ventilated, enclosed space or protected with suitable waterproof coverings.

C. Handling: Protect non-structural framing members from rusting and damage.

1.6 SEQUENCING

A. Coordinate placement of concealed internal wall reinforcement, such as backing plates, for items to be attached to metal support systems.

B. Coordinate installation of ceiling and soffit suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorage to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

C. Furnish concrete inserts, and other devices indicated, to other trades for installation well in advance of time needed for coordination with other construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design_Manufacturer: Subject to compliance with requirements, provide non-structural metal framing products by Clark Dietrich Metal Framing, Mill Certified, or comparable products by one of the following:
1. Clark Dietrich Metal Framing; a Worthington Industries Company.

2. MarinoWARE.
3. SCAFCO Corporation.
4. Steel Network, Inc. (The).
5. Other Manufacturer accepted by the Architect.

2.2 PERFORMANCE REQUIREMENTS

A.).

B. Performance Requirements: Provide metal framing assemblies to withstand the loads prescribed within the specified deflection limits.
   1. Deflection Limit per ASTM C 754: Allowing for 5 lbf/sq. ft (24 Pa) lateral load.
      a. Typical Finishes: L/240.
      b. Tile, Plaster, Stone or Similar Finishes: L/360.
   2. Where partition heights exceed stud manufacturer's recommended spans, and to resist deflection limits or seismic forces, provide one of the following:
      a. Heavier stud gage, except at walls with STC ratings.
      b. Closer stud spacing.
      c. Deeper stud size (space permitting, as determined by Architect).
      d. Above-ceiling bracing, anchored to structure above.
   3. Seismic Loads and design data are indicated on the Drawings.

C. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
   1. Conform to applicable code for fire rated assemblies. Construct assemblies to achieve fire resistance ratings indicated on Drawings in accordance with UL, GA, or other acceptable tested approved assemblies. Where no test number is referenced, utilize and submit a tested approved assembly that achieves the fire rating required by the Drawings, including the Life Safety Plan.
   2. Assemblies listed do not necessarily indicate all assemblies that may be used in this project. Contractor may propose alternate UL listed assemblies or approved tested assemblies that meet the same requirements to the Architect for consideration. Contractor may not substitute assemblies without written authorization by the Architect.
   3. Drawings, keys or written descriptions located in the Contract Documents to describe fire rated assemblies for beams, floors, roofs, columns, walls, partitions and through-penetration firestop systems do not necessarily call out each and every specific requirement of the designated UL listed assembly identified or approved tested assemblies. It is the Contractor's responsibility to become thoroughly familiar with the corresponding requirements published in the most recent issue of the Underwriters Laboratories Inc. Fire Resistance Directory and construct the fire rated assemblies in strict accordance with those requirements.
   4. Prescribed UL Design Numbers or approved tested assemblies which may be called for on this Project and may be required as determined during the construction process if existing conditions dictate. The list of assemblies below is not intended to represent all rated conditions designated in whole of the Contract Documents or those that may be considered viable alternates (where

approved by Architect). UL listed fire rated assemblies or approved tested assemblies include, but are not limited to the following:

a. Wall Systems: Refer to Drawings.
b. Through-Penetrations Firestop Systems: Refer to Section 07 84 13 "Penetration Firestopping."
c. Fire-Resistive Joint Systems: Refer to Section 08 84 46 "Fire-Resistant Joint Sealants."

D. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

E. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.3 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal at interior studs unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized, unless otherwise indicated.

B. Studs and Tracks: ASTM C 645. Use either steel studs and tracks or embossed steel studs and tracks.

C. Studs and Runners: ASTM C 645.
1. Steel Studs and Runners:
a. Minimum Base Metal Thickness: 0.033 inches unless otherwise indicated or required to comply with span and deflection design criteria, before application of protective coating.
b. Depth: 3-5/8 inches (92.1 mm) unless otherwise indicated or required to comply with span and deflection design criteria.
2. Embossed Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally equivalent to conventional ASTM C 645 steel studs and tracks.
a. Minimum Base-Metal Thickness: 0.0190 inch (0.483 mm).
b. Depth: 3-5/8 inches (92.1 mm) unless otherwise indicated or required to comply with span and deflection design criteria.

D. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Double-Runner System: ASTM C 645 top runners, inside runner with 4-inch-(101-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
2. Proprietary Deflection Track/Clips: Steel sheet top runner and clip system manufactured to prevent cracking of gypsum board applied to interior partitions resulting from deflection of structure above; in thickness indicated for studs and in width to accommodate depth of studs.
a. Products: Subject to compliance with requirements, provide one of the following:

1) Dietrich Metal Framing, "Fast Stop" clips, 0.064 inches (1.63 mm) thick, used in conjunction with 0.033 inch (0.8 mm) thick deep leg track.
2) Marino / WARE WSC-DEFLEX Series slide clips, used in conjunction with 0.033 inch (0.8 mm) thick deep leg track.
3) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
4) Stockton Products, Flexible Trak, FLT.

3. Substitutions: None permitted.
4. Single Deep-Leg Track: Not permitted.

E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.
b. The Steel Network, Inc.; VertiClip SLD Series or VertiTrack VTD Series.
c. Substitutions: Comparable product from another steel framing manufacturer listed, provided track system has been tested as part of an assembly according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
2. Single Deep-Leg Track: Not permitted.

F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm)

G. Cold-Rolled Channel Bridging: Steel, 0.053-inch (1.34-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
1. Depth: 1-1/2 inches (38 mm).
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068 inch-(1.72-mm-) thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm)
2. Depth: 7/8 inch (22.2 mm).

I. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical or hat shaped, with face attached to single flange by a slotted leg (web) or attached to two flanges by slotted or expanded metal legs.

J. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
1. Depth: 3/4 inch (19 mm).
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch (0.8 mm).

3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062 inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21 mm-) diameter wire.

K. Flexible Track for Studs: Galvanized steel flexible track and strap system designed to receive studs for framing curves; component sizes as indicated on Drawings.
1. Galvanized Steel: ASTM A 653, gage and grade as required for application.
2. Acceptable Product: Flex-Ability Concepts ; Flex-C Trac.

L. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-metal thickness of 0.018 inch (0.45 mm), and depth required to fit insulation thickness indicated.

M. Roller-shade attachment plates:
1. Z-shaped plates as indicated on the Drawings, for attaching roller window shades.
2. Thickness: 0.070-inch.

2.4 SUSPENSION SYSTEMS

A. Primary Suspension Members for Ceilings:
1. General: Size and provide ceiling support components to comply with ASTM C754.

B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

C. Hanger Attachments to Concrete:
1. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

D. Hangers: As follows:
1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.
2. Rod Hangers: ASTM A 510 (ASTM A 510M), mild carbon steel.
a. Diameter: 1/4-inch (6-mm).
b. Protective Coating: ASTM A 153/A 153M, hot-dip galvanized.
3. Flat Hangers: Commercial-steel sheet, ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized.
a. Size: 1 by 3/16 inch (25 by 5 mm) by length indicated.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.054 inch (1.34 mm) and minimum 1/2-inch- (13-mm-) wide flanges with ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized zinc coating.
1. Depth: 2-1/2 inches (64 mm).

F. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.054-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
   2. Steel Studs and Runners: ASTM C 645.
      a. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
      b. Depth: 1-5/8 inches (41 mm) unless noted otherwise.
   3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
      a. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
   4. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
      a. Configuration: Hat shaped, with face attached to two flanges by slotted or expanded metal legs.

G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock. Note: #8 gage hanger wire shall be required if spacing exceeds 3'x3' or 9 sf of ceiling area.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Armstrong World Industries, Inc.; Drywall Grid Systems.
      b. Chicago Metallic Corporation; Drywall Grid System.
      c. USG Corporation; Drywall Suspension System.
   2. Provide compression struts and sway bracing to resist seismic forces.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:
   1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
   2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

C. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
      b. Grabber Construction Products; Acoustical Sealant GSC.
      c. Pecora Corporation; AC-20 FTR.
      d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
      e. USG Corporation; SHEETROCK Acoustical Sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
   1. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
   2. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install bracing at terminations in assemblies.

C. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

D. Installation Tolerances: Install each steel partition, soffit, and ceiling framing and furring members to comply with the following:
   1. Variation in Level, Plumb, and True to Line: Maximum 1/8 inch (3 mm) in 10 feet (1:960).
   2. Variation in Plane of Adjacent Fastening Surfaces: Not more than 1/8 inch (3 mm) from the plane formed by the faces of adjacent framing.
   3. Variation in Framing and Furring Spacing: Not more than 1/8 inch (3 mm).

3.4 INSTALLING STEEL PARTITION FRAMED ASSEMBLIES

A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.
   1. Where studs are installed directly against exterior walls or dissimilar metals, install asphalt-felt or foam-gasket isolation strip between studs and wall.

B. Acoustical Sealant Installation at Sound Walls: Install in accordance with ASTM C 919.

1. Place two beads of acoustic sealant between runners and substrate studs and adjacent construction to achieve an acoustic seal.
2. Place two beads of acoustic sealant between studs and adjacent vertical surfaces board to achieve an acoustic seal.
3. As detailed on Drawings.

C. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.
   1. Space studs as follows:
      a. Single-Layer Construction: 16 inches (406 mm) o.c., unless otherwise indicated or required to comply with span and deflection design criteria.
      b. Multilayer Construction: 16 inches (406 mm) o.c., unless otherwise indicated or required to comply with span and deflection design criteria.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
      a. Use double runner system or proprietary deflection track at all locations except fire rated partitions.
      b. Use approved firestop track at fire rated partitions.
      c. Reference details on Drawings.
   2. Door Openings:
      a. Rough openings up to 50 inches (1270-mm) wide:
         1) Jamb: Install two boxed studs, minimum of 0.033 inches (0.84-mm) thick at each jamb unless otherwise indicated or required to comply with span and deflection design criteria.
            a) Extend jamb studs to underside of overhead structure and attach.
            b) Screw vertical studs at jambs to jamb anchor clips on door frames.
         2) Header: Install runner track section minimum of 0.033 inches (0.84-mm) thick or a box stud header, minimum of 0.018 inches (0.45 mm) thick, (for cripple studs) at head and secure to jamb.
            a) Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
      b. Rough openings over 50 inches (1270-mm) to 74 inches (1880-mm) wide:
         1) Jamb: Install two boxed studs, minimum of 0.054 inches (1.37-mm) thick at each jamb unless otherwise indicated or required to comply with span and deflection design criteria.
            a) Extend jamb studs to underside of overhead structure and attach.
            b) Screw vertical studs at jambs to jamb anchor clips on door frames.
         2) Header: Install a box stud header minimum of 0.054 inches (1.37 mm) thick, unless otherwise indicated.

a) Secure box header to jamb studs.
b) Install runner track section (for cripple studs) at head and secure to jamb studs.
c) Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.

c. Rough openings over 74 inches (1880 mm) wide and all lead lined and automatic doors:
1) Jamb: Install two boxed studs, minimum of 0.068 inches (1.72-mm) thick at each jamb unless otherwise indicated or required to comply with span and deflection design criteria or C3x5 steel channel.
a) Extend jamb studs to underside of overhead structure and attach.
b) Screw vertical studs at jambs to jamb anchor clips on door frames.
2) Header: Install a box stud header minimum of 0.068 inches (1.72-mm) thick, unless otherwise indicated or C4x5.4 steel channel.
a) Secure box header to jamb studs.
b) Install runner track section (for cripple studs) at head and secure to jamb studs.
c) Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Partitions Scheduled to Receive:
a. Tile Finish: Provide minimum of 0.033 inches (0.84 mm) thick studs.
b. Cementitious Backer Units: Provide minimum of 0.033 inches (0.84 mm) thick studs.
c. Bumper or Guard Rails: Provide minimum of 0.033 inches (0.84 mm) thick studs.
d. Equipment: Where wall mounted equipment, woodwork, and casework items are indicated or elsewhere as shown on Drawings, provide minimum of 0.033 inches (0.84 mm) thick studs.
5. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure, unless noted otherwise.
a. Firestop Track: Install to maintain continuity of fire-resistance-rated assembly indicated.
6. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
7. Curved Partitions:
a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.

E. Direct Furring:
   1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
   3. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
   4. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   5. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   6. Do not attach hangers to steel roof deck.
   7. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
   8. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
   9. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support. Provide compression struts installed at 12 feet on center each way to secure ceilings and soffits

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

3.6 METAL BACKING PLATES:

A. Provide metal backing plates to support loads imposed at wall-mounted and wall-hung items that require backing plates, include, without limitation, the following:
   1. Stereo cabinets.
   2. Toilet accessories, except grab bars.
   3. Metal lockers.
   4. Fire protection specialties.
   5. Markerboards.
   6. Tackboards.
   7. Millwork, other than upper cabinets.
   8. Medical equipment.
   9. Metal cabinets.
   10. Computer equipment wall mounting brackets.
   11. Medical equipment rails.
   12. Wall protection.

B. Backing plates not provided with fixtures and equipment shall be long enough to span across a minimum of 3 studs, unless otherwise indicated, and may be one of the following:
   1. Galvanized steel plate 0.053-inch (1.34-mm) thick minimum by 4 inches wide.
   2. 3-5/8 inches (92.1 mm) un-punched wide flange steel stud of 0.053 inch (1.34-mm) thick.
   3. At Contractor's option, solid wood blocking may be used in lieu of metal backing plates. Refer to Section 06 10 53 "Miscellaneous Carpentry."

C. Wood blocking will be acceptable at the following locations only:
   1. Television equipment.
   2. Wall-mounted door stops.
   3. Wall-mounted grab bars.
   4. Upper wall millwork / casework units.
   5. Wall-mounted handrails.
   6. Wall-mounted ladders.

D. Install backing plate so that it will be flush with exterior face of stud.

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.

B. Related Requirements:
1. Section 06 16 00 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 09 22 16 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
3. Section 09 21 16 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of gypsum board product, including related accessories. Furnish a material list with technical data documenting the location and primary function, quality, and performance of each material component or system to be used in the Work, or other such primary characteristics as required by the Drawings or Specifications.
1. Submit manufacturer's technical data for each gypsum drywall partition and each ceiling system.

B. Samples: For the following products:
1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.3 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. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated on Drawings in according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Possible alternate assemblies indicated by design designations from GA-600, "Fire Resistance Design Manual" may be submitted per substitution requirements.

D. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated on Drawings in according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
   1. Possible alternate assemblies indicated by design designations from GA-600, "Fire Resistance Design Manual" may be submitted per substitution requirements.

E. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. (9 sq. m) 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.
      b. Each texture finish indicated.
   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.

1.4 DELIVERY, STORAGE AND HANDLING

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

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
   1. Conform to applicable code for fire rated assemblies. Construct assemblies to achieve fire resistance ratings indicated on Drawings in accordance with UL, GA, or other acceptable tested approved assemblies. Where no test number is referenced, utilize and submit a tested approved assembly that achieves the fire rating required by the Drawings, including the Life Safety Plan.
   2. Assemblies listed do not necessarily indicate all assemblies that may be used in this project. Contractor may propose alternate UL listed assemblies that meet the same requirements to the Architect for consideration. Contractor may not substitute assemblies without written authorization by the Architect.
   3. Drawings, keys or written descriptions located in the Contract Documents to describe fire rated assemblies for beams, floors, roofs, columns, walls, partitions and through-penetration firestop systems do not necessarily call out each and every specific requirement of the designated UL listed or other approved tested assembly identified. It is the Contractor's responsibility to become thoroughly familiar with the corresponding requirements published in the most recent issue of the Underwriters Laboratories Inc. Fire Resistance Directory and construct the fire rated assemblies in strict accordance with those requirements and conforms to assemblies indicated on Drawings.
   4. Prescribed UL Design Numbers or other tested design which may be called for on this Project and may be required as determined during the construction process if existing conditions dictate. The UL assemblies or other tested designs indicated in the Contract Documents are not intended to represent all rated conditions designated in the Contract Documents or those that may be considered viable alternates (where approved by Architect). UL listed fire rated assemblies include, but are not limited to the following:
      a. Wall Systems: Refer to Drawings.
      b. Through-Penetrations Firestop Systems: Refer to Section 07 84 13 "Penetration Firestopping."
      c. Fire-Resistive Joint Systems: Refer to Section 07 84 46 "Fire-Resistant Joint Sealants."

B. STC-Rated Assemblies: For STC-rated assemblies indicated on Drawings or approved tested assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

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

2.3 INTERIOR GYPSUM BOARD

A. Basis of Design Manufacturers: Subject to compliance with requirements, provide products Georgia-Pacific Gypsum LLC, or comparable products by one of the following:
   1. American Gypsum.
   2. CertainTeed Corp.
   3. Georgia-Pacific Gypsum LLC.
   4. Lafarge North America Inc.
   5. National Gypsum Company.
   6. USG Corporation.

B. Gypsum Board, Type X [**GYP BD-1**]: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch (15.9 mm).
   2. Long Edges: Tapered

2.4 SPECIALTY GYPSUM BOARD

A. Glass-Mat Interior Gypsum Board [**GYP BD-2**]: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Georgia-Pacific Gypsum LLC; DensArmour Plus.
      b. Temple-Inland; GreenGlass Interior Glass-Mat Board.
   2. Core: 5/8 inch (15.9 mm), Type X.
   3. Long Edges: Tapered.
   4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

B. Acoustically Enhanced Gypsum Board [**GYP BD-3**]: ASTM C 1396/C 1396M. Multilayer products constructed of two layers of gypsum boards sandwiching a viscoelastic sound-absorbing polymer core.
   1. Core: 5/8 inch (15.9 mm), Type X.
   2. Long Edges: Tapered.

2.5 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board [**GYP BD-4**]: ASTM C 1178/C 1178M, with manufacturer's standard edges.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corp.; Diamondback GlasRoc Tile Backer.
      b. Georgia-Pacific Gypsum LLC; DensShield Tile Backer.
      c. National Gypsum; e2XP Tile Backer.
      d. Temple-Inland; GreenGlass Fiberglass-Faced Tile Backer
   2. Core: 5/8 inch (15.9 mm), Type X.
   3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. C-Cure.
   b. CertainTeed Corporation.
   c. National Gypsum Company.
   d. USG Corporation.
2. Thickness: 5/8 inch (15.9 mm).
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Control (expansion) joints.
      b. Cornerbead.
      c. Bullnose bead.
      d. LC-Bead (J-Bead): J-shaped; exposed long flange receives joint compound.
      e. L-Bead: L-shaped; exposed long flange receives joint compound.
      f. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      g. Curved-Edge Cornerbead: With notched or flexible flanges.
      h. Curved Inside Corner:
         1) Acceptable Product: Fry Reglet, DRMCIS-200.

B. Vinyl Trim: ASTM C 1047.
   1. Manufacturer: Trim-Tex.
      a. Super Seal Tear Away L Bead.
      b. Wall Mounted Deflection Bead.
      c. Shapes indicated on the Drawings.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Fry Reglet Corp.
      b. Gordon, Inc.
      c. Pittcon Industries.
   2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
   3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
   4. Shapes:
      a. Fry Reglet Corner Trim DMCT-1250; Dimensions: 1 1/4-inches.
      b. Pittcon 90^0 outside corner, SO-HSE-90
      c. Pittcon 45^0 outside corner, SO-45A.
      d. Pittcon 60^0 outside corner, SO-60A.
      e. Shapes indicated on the Drawings.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Board: Paper.
   2. Glass-Mat Gypsum Board: 10-by-10 glass mesh.
   3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound, or use drying-type, all-purpose compound.
   5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
   2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Adhesives and Sealants: Use adhesives and sealants that meet 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."

C. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

D. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

E. Electrical Box Pads: Putty Pads: Moldable non-curing one component, intumescent, fire-rated material for through-penetration fire stop systems and sound attenuation systems; self-adhering; 1/8 inch thick minimum.

F. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Provide slag-wool-fiber/rock-wool-fiber insulation with recycled content so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.
   2. Formaldehyde Free: Provide formaldehyde-free products, or low emitting products when tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.
   3. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly. With thermal conductivity of "k" = 0.25 Btu in./hr. $ft.^2$ °F. at 75 deg. F. Minimum 3 pcf density. ASTM E84, flame spread 15, smoke developed 10, or less.
   4. Provide manufacturer's standard sizes in thickness indicated. Provide one of the following:
      a. Thermafiber LLC; Sound Attenuation Fire Blankets.
      b. Fibrex Inc.; FBX Sound Control Blanket.
      c. Roxul Inc.; Acoustical Fire Batt.

G. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
      b. Grabber Construction Products; Acoustical Sealant GSC.
      c. Hilti Incorporated; CP 506 Smoke and Acoustic Sealant.
      d. Pecora Corporation; AC-20 FTR.
      e. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
      f. Tremco; Acoustical Sealant.
      g. USG Corporation; SHEETROCK Acoustical Sealant.

H. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 PUTTY PADS FOR SMOKE / FIRE-RATED AND STC-RATED WALLS

A. Prior to installing wallboards, install putty pads in accordance with manufacturer's written instructions.

B. Overlap front edge of box so that putty will be compressed around edges of box as gypsum panels are installed.

3.3 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch (6.4- to 12.7-mm-) wide spaces at these locations, unless otherwise indicated on Drawings, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated and Smoke Rated Assemblies: Seal construction at perimeters, behind control 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 with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.4 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Type X: Vertical surfaces unless otherwise indicated.
   2. Flexible Type: Apply in double layer at curved assemblies where indicated on drawings.
   3. Glass-Mat Interior Type:
      a. Interior side (face) of exterior walls.
      b. Interior partitions where Contractor desires to install gypsum board prior to building dry-in.
      c. On tile walls, unless noted otherwise.
      d. Wet locations 4'-0" to each side of water source.
      e. At Interior Finish System locations.
      f. First layer at locations where tile backer is the second layer.
      g. Where indicated.
   4. Tile Backer-Glass-Mat Type:
      a. Walls in toilet room with shower.
      b. Tiled walls in showers and bathtubs.
      c. Behind prefabricated shower or bathtub units.
      d. Plumbing walls of toilet rooms.
      e. Where indicated.
   5. Cementitious Backer Units:
      a. Where indicated.

B. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
   3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:
   1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.5 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
1. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.
2. Do not install screws within 6 inches of the shower wall base so as to not penetrate shower pan waterproofing.

B. Cementitious Backer Units: ANSI A108.11, Where indicated.

3.6 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints as indicated on Drawings. If not indicated install according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.
2. Bullnose Bead: Use at outside corners.
3. LC-Bead (J-Bead): J-shaped: Use at exposed panel edges.
4. L-Bead: L-shaped: Use where indicated.
5. U-Bead: J-shaped: Use at exposed panel edges where indicated.
6. Curved-Edge Cornerbead: Use at curved openings.
7. Curved Inside Corner: Use where indicated.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.7 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   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. Level 1 finish shall be applied at ceiling plenum areas, concealed areas.
   2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges. Level 2 finish shall be applied to WR gypsum board, where panels are substrate for tile, and other locations where indicated.
   3. Level 3: Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges. Joint compound shall be smooth and free from tool marks and ridges. Level 3 finish shall be applied to panels in Mechanical Rooms, Electrical Rooms, and similar spaces.
   4. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges. Joint compound shall be smooth and free from tool marks and ridges. Level 4 finish shall be applied to panels in all locations except where another level of finish is specified.
      a. Primer and its application to surfaces are specified in other Section 09 91 00 "Painting."
   5. Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface where indicated. Level 5 finish shall be applied at exposed locations utilizing glass mat interior gypsum board products. At all exposed drywall surfaces within main entrance hallways, elevator corridors, and areas scheduled to receive accent lighting, display wall coatings, graphic painting, gloss or semi-gloss finishes, refer to room finish schedules for locations. Where indicated on Drawings.
      a. Primer and its application to surfaces are specified in other Section 09 91 00 "Painting."

E. Glass-Mat Faced Tile Backer Panels: Finish according to manufacturer's written instructions.

F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before installing gypsum board ceilings, conduct an above-ceiling inspection, and report and correct deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
   1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for Contractor’s above-ceiling inspection. Provide Architect with copy of deficiencies report. Architect reserves the right to supplement Contractor’s deficiency report with other incomplete or incorrect items that might be observed during Architect’s site visit.

2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
    a. Installation of 80 percent of lighting fixtures, powered for operation.
    b. Installation, insulation, and leak and pressure testing of water piping systems.
    c. Installation of air-duct systems.
    d. Installation of air devices.
    e. Installation of mechanical system control-air tubing.
    f. Installation of ceiling support framing.
    g. Installation of seismic restraints (sway bracing and compression struts).
    h. Touch-up / patching of spray fire-resistive materials (SFRM).
    i. Installation of penetration firestopping in fire- and smoke-rated partitions.
    j. Installation of fire-resistant joint sealants in fire-rated partitions.
    k. Installation of acoustical sealants at adjacent sound-rated partitions.

3.9 ACOUSTIC TESTING

A. The Owner may have periodic sound tests made, at his option, as the work progresses. The Contractor shall make necessary modifications of partitions that are found to be substandard (not meeting approximate sound attenuation levels established by tests listed in manufacturer's data sheets) for that particular partition construction.
    1. Costs of testing of partitions when found to be substandard shall be paid for by the Contractor, including cost of retesting of modified partitions.
    2. Cost of testing partitions found to comply with sound attenuation levels required, will be paid for by the Owner.

3.10 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

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

END OF SECTION

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for ceilings.
   1. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 150 mm (6 inches) in size.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panel: Set of 150-mm- (6-inch-) square Samples of each type, color, pattern, and texture.
   2. Exposed Suspension-System Members, Moldings, and Trim: Set of 150-mm- (6-inch-) long Samples of each type, finish, and color.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Suspended ceiling components.
   2. Structural members to which suspension systems will be attached.
   3. Size and location of initial access modules for acoustical panels.
   4. Items penetrating finished ceiling including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
   5. Perimeter moldings.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 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. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
   2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
   3. Hold-Down Clips: Equal to 2 percent of quantity installed.
   4. Impact Clips: Equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

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

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of typical ceiling area as shown on Drawings.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 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.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work 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.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. 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."

B. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
   2. CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings – Seismic Zones 0-2."
   3. CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies – Seismic Zones 3 & 4."

C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
   2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 30 percent by weight, minimum average for mineral acoustical panels.

B. Source Limitations:
   1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
   2. Suspension System: Obtain each type from single source from single manufacturer.

C. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 400 mm (15-3/4 inches) away from test surface according to ASTM E 795.

E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Basis of Design Products: Subject to compliance with requirements, provide Certain Teed Ceilings; Solo, unless another product is listed in the Materials Legend, on the Drawings, or provide a comparable product by one of the listed acceptable manufacturers.

C. Acceptable Manufacturer:
   1. Armstrong World Industries, Inc.
   2. CertainTeed Corp.
   3. USG Interiors, Inc.; Subsidiary of USG Corporation.

D. Colors: As indicated in the Materials Legend, on the Drawings, or if not listed as selected by the Architect.

E. Sizes: As indicated, on the Drawings.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. 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/C 635M.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
      a. Type: Cast-in-place or Postinstalled expansion anchors.
      b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 2.69-mm- (0.106-inch-) diameter wire.

E. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

G. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.

H. Hold-Down Clips: Within 10 feet of exterior doors and where indicated, provide manufacturer's standard hold-down clips spaced 610 mm (24 inches) o.c. on all cross tees.

2.5 METAL SUSPENSION SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong World Industries, Inc.
   2. CertainTeed Corp.
   3. Chicago Metallic Corporation.
   4. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Manufacturer’s standard mounting system, as indicated on the Drawings; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than Z90 (G30) coating designation.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong World Industries, Inc.
   2. CertainTeed Corp.
   3. Chicago Metallic Corporation.
   4. Fry Reglet Corporation.
   5. Gordon, Inc.
   6. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221M (ASTM B 221) for Alloy and Temper 6063-T5.
2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 0.04 mm (1.5 mils). Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, provide one of the following:
1. Acoustical Sealant for Exposed and Concealed Joints:
a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. USG Corporation; SHEETROCK Acoustical Sealant.
c. PL Acoustical Sealant; Chemrex, Inc., Contech Brands.

B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.

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 and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
   1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. 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.
   4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
   6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
   7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
   8. Do not attach hangers to steel deck tabs.
   9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   10. Space hangers not more than 1200 mm (48 inches) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 200 mm (8 inches) from ends of each member.

11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
12. When extending existing acoustical ceiling within a room, match existing grid pattern. Discontinuous grid patterns are prohibited.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 400 mm (16 inches) o.c. and not more than 75 mm (3 inches) from ends, leveling with ceiling suspension system to a tolerance of 3.2 mm in 3.6 m (1/8 inch in 12 feet). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as follows:
   a. As indicated on reflected ceiling plans.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. 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.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down and / or impact clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.

G. Where existing ceilings are present:
1. Rework existing ceiling grid as required to maintain a continuous pattern within each room. Group new and existing tiles into areas for consistency, matching color and texture.
2. Replace damaged, cracked, stained, or missing ceiling tiles throughout the areas of project as needed with tiles to match existing pattern and color.

3. Reseat insulation above existing ceiling tile where disturbed. Leave insulation in continuous plane, tightly butted throughout. Do not cover light fixtures.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Compliance of seismic design.

B. Testing Agency: Owner will 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 890 N (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 1957 N (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

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SECTION 09 61 00

CONCRETE FLOOR TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section include the following:
   1. Sealing of concrete floor areas not scheduled to receive finish floor covering.
   2. Cleaning and sealing of existing concrete floors not scheduled to receive finish floor covering.

1.2 DESIGN REQUIREMENTS

A. Verify concrete slab is properly prepared to receive coating system.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Informational Submittals: Submit following:
   1. Test Reports: For pre-installation substrate moisture and alkalinity tests.
   2. Certifications specified in Quality Assurance article.
   3. Qualification Data: Manufacturer's and applicator's qualification data.
   4. Manufacturer’s instructions.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Record Documents: Showing locations of substrate moisture and alkalinity tests. Provide markups on floor plan indicating the location of each test and the dates tests were performed.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this Section with minimum 5 years documented experience.

B. Applicator Qualifications: Acceptable to manufacturer with documented experience on at least 5 projects of similar nature in past 5 years.

C. Substrate Moisture and pH Testing:
   1. Perform pre-installation testing of the concrete slab by a calcium chloride test, or as otherwise required by flooring manufacturer, prior to the application of flooring products in accordance with ASTM F 1869 – 98.
   2. Perform testing by qualified personnel.

3. Determine the change in weight of moisture-absorbing anhydrous calcium chloride and represent the amount of moisture transmitting out of the concrete slab area.
4. Express the value in pounds as the equivalent weight of water that is emitted from a 1,000 square foot concrete slab surface area in a 24 hour period of time.
5. Provide pH testing of substrate.
6. Provide a diagram of the building verifying each testing location with its results.
7. Provide 3 tests per 1000 square feet of floor area plus one additional test for each 1000 square feet thereafter. Locate tests in various parts of the floor area including the center of the floor and sites of potential moisture such as the perimeter of the floor, joints, or cracks.
8. Acceptable Product: Concrete Vapor and pH Testing Kits as manufactured by Vaprecision Testing Systems, 800-449-6194.

D. Preinstallation Conference: Conduct conference with attendance and participation of the following:
1. Owner.
2. Architect.
3. Contractor.

E. Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to flooring application including, but not limited to, the following.
1. Review methods and procedures related to flooring installation, including manufacturer's written instructions.
2. Review concrete substrate requirements for conditions affecting performance of flooring, including results of moisture and alkalinity tests.
3. Review locations and frequency of moisture and alkalinity tests.

1.7 FIELD SAMPLES

A. General: Comply with Section 01 40 0.
1. Sample Installation:
a. Provide field sample with base in area indicated 100 square feet (of 9 m2) of flooring, including 3 feet (900 mm) of base.
b. When accepted, field sample will demonstrate minimum standard for Project. Approved field sample may remain as part of Work.

1.8 PRE-INSTALLATION CONFERENCE

A. Minimum Agenda:
1. Review Project Specifications and Drawings.
2. Establish acceptable concrete substrate requirements and remedial measures for cracks.
3. Review installation procedures, including:
a. Mixing requirements.
b. Thickness and levelness tolerances.
c. Finishing requirements.
d. Phasing requirements.
e. Review inspection, testing, and quality control procedures.

f. Review protection requirements for construction period beyond flooring installation.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manner to prevent damage to containers and bags.

B. Store materials in accordance with manufacturer's instructions in clean and dry location with temperature between 60 F and 90 F (16 C and 32 C).

1.10 PROJECT CONDITIONS

A. Environmental Requirements:
1. Do not install concrete floor treatments until slabs have cured and are sufficiently dry, as determined by concrete floor treatment manufacturer's recommendations, and field moisture and alkalinity tests.
2. Do not install flooring when slab temperature is below 55 F (13 C) or above 90 F (32 C).
3. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of flooring.
4. Ventilate area where flooring is being installed.
5. Indoor Air Quality Procedures: Ventilate in accordance with Section 01 81 13 Sustainable Design Requirements.

PART 2 - PRODUCTS

2.1 CONCRETE SEALING

A. Hardening/Dustproofing/Sealing [**CF2**]:
1. Water-based, colorless, odorless solution of specialized reactive chemicals which penetrates concrete surfaces to seal, densify and harden.
2. Basis of Design Manufacturer/Product: Subject to compliance with the requirements, provide Prosoco; Consolideck® LS/CS® or a comparable product by another manufacturer, acceptable to the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions prior to beginning Work.
1. Examine areas to receive concrete floor treatment for:
a. Defects in substrate that may affect proper execution of flooring work.
b. Deviations beyond allowable tolerance for concrete slab work.
c. Surface curing agents or sealers that would inhibit penetration.
d. Surface defects such as cracks that could transfer through to finished flooring surface if not corrected.
2. Do not begin floor treatment work until concrete substrate has cured 28 days, minimum.
3. Do not begin work until unsatisfactory conditions have been corrected.

B. Concrete Floors: 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 substrate moisture and alkalinity tests.

3.2 PREINSTALLATION TESTING

A. General: Perform preinstallation testing.

B. Submit copies of test reports and concrete floor treatment manufacturer's written acceptance of substrate conditions to Owner and Architect prior to flooring installation.

C. If test results indicate concrete subfloor is not within flooring manufacturers' acceptable range, notify Owner and Architect.

3.3 PREPARATION

A. Prepare Substrate: Tests concrete substrate for pH, contaminants, and moisture content in accordance with manufacturer's recommendations. Ensure concrete is within manufacturers recommended limits prior to installation.

B. Concrete Sub-floors: Verify that concrete slabs comply with the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with penetration.
   2. Mechanically abrade or shot-blast concrete flooring to remove inappropriate curing agents and to open pores of concrete surfaces to allow penetration of treatment agent. Completely remove cleaning residue. Acid washing is not acceptable.
   3. Repair cracks, divots and surface imperfections according to manufacturer's instructions.
   4. Vacuum to remove dust and debris.

3.4 APPLICATION

A. General: Apply concrete floor treatment according to manufacturer's instructions.
   1. Provide uniform monolithic wearing surface uninterrupted except where indicated or required.

B. Joint Sealants: Where substrate is interrupted by expansion or control joints, provide joint in floor to comply with details indicated or as recommended by flooring manufacturer and section 07 92 00 Joint Sealants.

3.5 CURING

A. Cure flooring materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process.
   1. Indoor Air Quality Procedures: Ventilate in accordance with Section 01 81 13 Sustainable Design Requirements.

3.6 CLEANING

A. Clean as recommended by manufacturer. Do not use materials or methods which may damage surface or surrounding construction.
   1. Remove temporary covering and clean flooring prior to final inspection. Use cleaning materials and procedures recommended by flooring manufacturer.
   2. Do not permit traffic over finished flooring surfaces.

3.7 PROTECTION

A. Protect flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application.

END OF SECTION

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SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Resilient base.
2. Resilient molding accessories.

B. Related Sections:
1. Division 09 Section "Static-Control Resilient Flooring" for resilient floor coverings designed to control electrostatic discharge.

1.2 ACTION SUBMITTALS

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

B. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 300 mm (12 inches) long, of each resilient product color, texture, and pattern required.

C. Product Schedule: For resilient products. Use same designations indicated on Drawings.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain each type and color of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

C. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

D. Mockups: Provide resilient products with mockups specified in other Sections.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 10 deg C (50 deg F) or more than 32 deg C (90 deg F).

C. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.5 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 21 deg C (70 deg F) or more than 35 deg C (95 deg F), in spaces to receive resilient products during the following time periods:
1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 13 deg C (55 deg F) or more than 35 deg C (95 deg F).

C. Install resilient products after other finishing operations, including painting, have been completed.

D. For resilient products installed on traffic surfaces, close spaces to traffic during installation and for time period after installation recommended in writing by manufacturer.

1.6 EXTRA MATERIALS

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 not less than 3 linear m (10 linear feet) for every 150 linear m (500 linear feet) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. FloorScore Compliance: Resilient base shall comply with requirements of FloorScore Standard.

B. Resilient Base:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Allstate Rubber Corp.; Stoler Industries.
b. Armstrong World Industries, Inc.
c. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
d. Endura Rubber Flooring; Division of Burke Industries, Inc.

e. Estrie Products International; American Biltrite (Canada) Ltd.
f. Flexco, Inc.
g. Johnsonite.
h. Mondo Rubber International, Inc.
i. Musson, R. C. Rubber Co.
j. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
k. PRF USA, Inc.
l. Roppe Corporation, USA.
m. VPI, LLC; Floor Products Division.

C. Resilient Base Standard: ASTM F 1861.
1. Material Requirement: Type TS (rubber, vulcanized thermoset).
2. Manufacturing Method: Group I (solid, homogeneous).
3. Style:
a. Cove (base with toe) at floors, unless otherwise indicated.
b. Straight (flat or toeless) at floors with carpet finish.
4. Minimum Thickness: 3.2 mm (0.125 inch).
5. Height: 4 inches, unless otherwise indicated.
6. Lengths: Coils in manufacturer's standard length.
7. Outside Corners: Preformed.
8. Inside Corners: Job formed or preformed.
9. Finish: Matte.
10. Colors and Patterns: As indicated in the Materials Legend, on the Drawings.

2.2 RESILIENT MOLDING ACCESSORY

A. FloorScore Compliance: Resilient molding accessiries shall comply with requirements of FloorScore Standard.

B. Resilient Molding Accessory:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
b. Flexco, Inc.
c. Johnsonite.
d. R.C.A. Rubber Company (The).
e. Roppe Corporation, USA.
f. VPI, LLC; Floor Products Division.

C. Types:
1. Reducer strip for resilient floor covering.
2. Transition strips.

D. Material: Rubber.

E. Profile and Dimensions: .Unless otherwise indicated, products listed below are those of Johnsonite and are listed as a minimum standard of quality.
1. Resilient Tile-to-Sheet Vinyl: RRS-XX-D.
2. Resilient Tile-to-Concrete: RRS-XX-D.

F. Colors and Patterns: As indicated in the Interior Finish Legend on the Drawings.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Sealant: Silicone sealant acceptable to resilient base and sheet vinyl flooring manufacturers. Refer to Section 07 92 00.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. 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.

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

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are same temperature as the space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

D. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:
   1. Inside Corners: Use straight pieces of maximum lengths possible.

H. Preformed Corners: Install preformed corners before installing straight pieces

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of resilient floor covering that would otherwise be exposed.

C. Sealant (in wet areas, and where indicated): Apply sealant to seal joint between resilient base and sheet vinyl flooring. Comply with base, flooring, and sealant manufacturers' published instructions.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

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. Do not wash resilient products until after time period recommended by resilient product manufacturer.
   4. Damp-mop surfaces to remove marks and soil.

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 indicated or recommended in writing by resilient product manufacturer.

D. Clean resilient products not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.

END OF SECTION

SECTION 09 65 36

STATIC-CONTROL RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Static-dissipative, rubber sheet flooring.
2. Static-dissipative, rubber floor tile.

B. Related Requirements:
1. Section 09 65 13 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with static-control resilient flooring.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to static-control resilient flooring including, but not limited to, the following:
a. Examination and preparation of substrates to receive static-control resilient flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of static-control resilient flooring. Include floor-covering layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
1. Show details of special patterns.
2. Show locations of inscribed maintenance tiles.
3. Submit grounding diagram showing location of grounding strips and connections.

C. Samples for Verification: For each type of static-control resilient flooring, of size indicated below:
1. Floor Tile: Full-size units.

D. Product Schedule: For static-control resilient flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for static-control resilient flooring.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of static-control resilient flooring to include in maintenance manuals.

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

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for static-control resilient flooring.
   1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups for static-control resilient flooring including resilient base and accessories.
      a. Size: Minimum 100 sq. ft. (9.3 sq. m) for each type, color, and pattern in locations directed by Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store static-control resilient flooring 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 (10 deg C) or more than 90 deg F (32 deg C).
   1. Floor Tile: Store on flat surfaces.

1.9 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C), in spaces to receive static-control resilient flooring during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Close spaces to traffic during static-control resilient flooring installation.

C. Close spaces to traffic for 48 hours after static-control resilient flooring installation.

D. Install static-control resilient flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Static-Dissipative Properties: Provide static-control resilient flooring with static-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.
1. Electrical Resistance: Test per ASTM F 150: $10^6 < 10^9$ (ohms) when installed floor coverings are tested surface to ground.
2. Static Generation: ANSI ESD S97.2, < 20 Volts.
3. Static Decay: FTM 101 C 4046, < 0.25, (sec).

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."

C. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 STATIC-DISSIPATIVE RESILIENT FLOOR COVERINGS

A. Static-Dissipative Sheet Rubber Flooring: ASTM F 1344; except in manufacturer's standard hardness when tested per ASTM D 2240 using Shore, Type A durometer.
1. Smooth-Surface Sheet Flooring: Class I-B (homogenous rubber, through-mottled pattern).
   a. Manufacturer: Subject to compliance with requirements, provide products indicated in the Materials Legend, on the Drawings, or comparable products by one of the following:
      1) Nora Systems, Inc.
      2) PRF USA Inc.
   b. Thickness: 2 mm.
   c. Size: 48 inch width.
   d. Seaming Method: Standard.
   e. Colors and Patterns: As indicated in the Materials Legend, on the Drawings.

B. Static-Dissipative Rubber Floor Tile: ASTM F 1344; except in manufacturer's standard hardness when tested per ASTM D 2240 using Shore, Type A durometer.
1. Smooth-Surface Floor Tile: Class I-B (homogenous rubber, through-mottled pattern).
   a. Manufacturer: Subject to compliance with requirements, provide products indicated in the Materials Legend, on the Drawings, or comparable products by one of the following:
      1) Nora Systems, Inc.
      2) PRF USA Inc.
   b. Thickness: 2 mm.
   c. Size: 25 by 25 inches.

d. Seaming Method: Standard.
e. Colors and Patterns: As indicated in the Materials Legend, on the Drawings.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified portland cement or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Static-Control Adhesive: Provided or approved by manufacturer; type that maintains electrical continuity of floor-covering system to ground connection.
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."

C. Grounding Strips: Provided or approved by manufacturer; type and size that maintains electrical continuity of floor-covering system to ground connection.

D. Maintenance Floor Tiles: Special floor tiles inscribed "Conductive floor. Do not wax."

E. Floor Polish: Provide protective, static-control liquid floor polish products as recommended by floor-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer and manufacturer's representative present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. 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 or static-control characteristics of floor coverings.

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

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions and with oversight by manufacturer's representative to ensure adhesion of static-control resilient flooring and electrical continuity of floor-covering systems.

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 floor-covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
   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. (1.36 kg of water/92.9 sq. m) in 24 hours.
   b. Perform relative-humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative-humidity level measurement.

C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install static-control resilient flooring until it is same temperature as space where it is to be installed.
   1. Move static-control resilient flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

F. Sweep and vacuum substrates to be covered by static-control resilient flooring immediately before installation.

3.3 INSTALLATION, GENERAL

A. Install static-control resilient flooring according to manufacturer's written instructions and with oversight by manufacturer's representative.

B. Embed grounding strips in static-control adhesive. Extend grounding strips beyond perimeter of static-control resilient floor-covering surfaces to ground connections.

C. Scribe, cut, and fit static-control resilient flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

D. Extend static-control resilient flooring into toe spaces, door reveals, closets, and similar openings. Extend static-control resilient flooring to center of door openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on static-control resilient flooring as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Install static-control resilient flooring on covers for telephone and electrical ducts, and similar items in installation areas. Maintain overall continuity of color and pattern with pieces of static-control resilient flooring installed on covers. Tightly

adhere static-control resilient flooring edges to substrates that abut covers and to cover perimeters.

G. Adhere static-control resilient flooring to substrates using a full spread of static-control 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.

3.4 FLOOR-TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half floor tile at perimeter.
   1. Lay floor tiles square with room axis, unless otherwise indicated.

C. Match floor tiles for color and pattern by selecting floor tiles from cartons in same sequence as manufactured and packaged if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.

D. In each space where conductive, rubber floor tile is installed, install maintenance floor tile identifying conductive floor tile in locations approved by Architect.

3.5 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified testing agency to test electrical resistance of static-control resilient flooring for compliance with requirements.
   1. Arrange for testing after static-control adhesives have fully cured and static-control resilient flooring has stabilized to ambient conditions and after ground connections are completed.
   2. Arrange for testing of static-control resilient flooring before performing floor polish procedures.

B. Static-control resilient flooring will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of static-control resilient flooring.

B. Perform the following operations immediately after completing static-control resilient flooring:
   1. Remove static-control adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect static-control resilient flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
   1. Do not wax static-control resilient flooring.
   2. If recommended in writing by manufacturer, apply protective static-control floor polish formulated to maintain or enhance floor covering's electrical properties; ensure static-control resilient flooring surfaces are free from soil, static-control adhesive, and surface blemishes.
      a. Verify that both floor polish and its application method are approved by manufacturer and that floor polish will not leave an insulating film that reduces static-control resilient flooring's effectiveness for static control.
   3. Cover static-control resilient flooring until Substantial Completion.

END OF SECTION

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SECTION 09 68 16

SHEET CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Tufted broadloom carpeting.
a. Direct glue down installation.
2. Subfloor preparation.

B. Related Requirements:
1. Division 02 Section "Selective Structure Demolition" for removing existing floor coverings.
2. Division 03 Section ‘Cast-in-Place Concrete” for concrete floor slab requirements.
3. Division 09 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with broadloom carpet.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to carpet installation including, but not limited to, the following:
a. Review delivery, storage, and handling procedures.
b. Review ambient conditions and ventilation procedures.
c. Review subfloor preparation procedures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:
1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Existing flooring materials to be removed.
3. Existing flooring materials to remain.
4. Carpet type, color, and dye lot.
5. Locations where dye lot changes occur.
6. Seam locations, types, and methods for broadloom carpeting.
7. Type of subfloor.
8. Type of installation.
9. Pattern type, repeat size, location, direction, and starting point.
10. Pile direction.
11. Type, color, and location of insets and borders.

12. Type, color, and location of edge, transition, and other accessory strips.
13. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
1. Carpet: 12-inch- (300-mm-) square Sample. Provide samples showing complete range of color and pattern for each type of carpet specified.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.
3. Carpet Cushion: 6-inch- (150-mm-) square Sample.
4. Carpet Seam: 6-inch (150-mm) Sample.
5. Mitered Carpet Border Seam: 12-inch- (300-mm-) square Sample. Show carpet pattern alignment.

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

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet, for tests performed by a qualified testing agency.

C. Test Reports: From Testing Agency for pre-installation substrate moisture and alkalinity tests.

D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.6 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. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

B. Submit a copy of itemized receipt for extra material turned over to the Owner signed by the Owner’s representative.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer with experience in the installation of commercial carpeting in projects of similar size and scope specified herein, to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.
   1. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Master II certification level.

B. Single-Source Responsibility: Obtain each type of carpet from one source and by a single manufacturer.

C. Fire-Test-Response Ratings: Where indicated, provide carpet identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

D. Provide carpet material meeting the following:
   1. Flame Spread: ASTM E 84, 75 or less.
   2. Critical Radiant Flux Classification: A minimum radiant flux of 0.50 watts/sq. cm in corridors and 0.40 watts/sq. cm. in general areas of at least 15 minutes duration when tested in accordance with ASTM E648, based on the average of three replicate tests.
   3. Radiant Panel Classification: A specific optical density in either the flaming or non-flaming mode not exceeding 300 within the first 4 minutes of the test when tested in accordance with ASTM E662.
   4. DOC FF 1-70 or ASTM D2859, Methanine Pill Test, with a passing rating.
   5. Resistance to Insects: Comply with AATCC-24.
   6. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC-165.
   7. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) per AATCC-16.
   8. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC-174.
   9. Meet local city code and fire marshal's requirements.

E. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockups at locations and in sizes shown on Drawings.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.9 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet 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.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.10 WARRANTY

A. General Warranty: Special warranty specified in this Article is not to deprive Owner of other rights Owner may have under other provisions of the Contract Documents and is in addition to, and is to run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, and delamination.
   3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. Recycled Content: Provide products with an average recycled content of carpet and carpet backing products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 10 percent.

B. Carpet Fibers: Types as scheduled and as recommended by the carpet manufacturer for the conditions of installation and use.

C. Pile Yarn: Provide yarn spun in the manner recommended by the yarn manufacturer and the carpet manufacturer, in number of plies and denier indicated or required, to achieve the pile yarn weight, texture and pattern indicated.

D. Dye: Use dyes and dyeing methods recognized by the industry as successful for the type of fiber being dyed and to achieve the required colors and fade resistance. Achieve the fade resistance established by the Association of Textile Chemists and Colorists for carpet when tested on the Atlas Fadeometer for 40 hours.

E. Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

2.2 TUFTED CARPET

A. Basis of Design Manufacturer: Subject to compliance with requirements, provide carpet by Mohawk, or comparable product by another manufacturer accepted by the Architect.

B. Products: as indicated in the Interior Material Legend, on the Drawings.

C. Performance Characteristics: As follows:
1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D 7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
3. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D 2646.
4. Tuft Bind: Not less than 8 lbf (36 N) according to ASTM D 1335.
5. Delamination: Not less than 4 lbf/in. (18 N/mm) according to ASTM D 3936.
6. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
7. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
8. Resistance to Insects: Comply with AATCC 24.
9. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
10. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) according to AATCC 16, Option E.
11. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.
12. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

D. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

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 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 carpetmanufacturer.
   2. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving carpet.
   3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

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

3.2 PREINSTALLATION TESTING

A. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

B. Moisture Testing: Perform tests recommended by floor covering manufacturer to maintain manufacturer's warranty or the following, whichever is more stringent. Proceed with installation only after substrates pass testing.
   1. In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative-humidity-level measurement.
      a. Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
   2. Provide a diagram of the building verifying each testing location with its results.
   3. Submit floor covering and adhesive manufacturer’s written acceptance of the concrete floor substrate as represented by moisture and alkalinity testing.
   4. Submit copies of test reports and flooring manufacturer’s written acceptance of substrate conditions to Construction Manager, Owner and Architect prior to flooring installation.

C. If test results indicate concrete subfloor is not within flooring manufacturers’ acceptable range, notify Owner and Architect.

3.3 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions. Install trowelable leveling and patching compound at transitions in flooring and at floor tracks for full height all glass sidelites and partitions to provide a smooth gradual ramped transition not to exceed a 1 to 12 slope.

C. Remove coatings, including curing compounds, 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 carpet manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.4 INSTALLATION – GENERAL

A. Install carpet with all rows of yarn running in same direction, on a floor except where otherwise specifically approved by Architect. Follow final reviewed shop drawings indicating pattern and seaming layout as reviewed by Architect. Side to end seaming is not acceptable.

B. Install carpet in accordance with final reviewed shop drawings and manufacturer's printed instructions and recommendations.

C. Install carpet around floor outlets or similar obstructions. Electrical or mechanical plates where used are to rest on the top surface of the carpet.

D. Report obstructions which may occur to Architect prior to any work or fabrication. Extend carpet into areas such as, under convector units, at columns, and at alcoves/recesses, so that areas are completely covered with carpet without any exposed areas.

E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. After Installer knows roll sizes and prior to installation, inform Architect in writing of any layout changes from final reviewed shop drawings. Such changes must receive written approval of Architect prior to installation.

G. Do not install carpet and related materials where there is excessive moisture present, nor when temperatures are less than 50 deg F.

H. In general, install carpet beginning from center of columns or areas and work toward the periphery.

I. Do not allow heavy foot traffic on newly carpeted area for at least 6 hours.

J. Install transition strips at carpet terminations and flooring material changes. Compensate for variations at the junction of carpet and other flooring material by beveling of transition strips, feathering floor or shimming edge or transition strip.

K. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

L. Center change of flooring, and where applicable, transition strips under door in closed position and at room side of cased openings without doors.

M. Do not bridge building expansion joints with carpet.

N. Cut and fit carpet 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.

3.5 INSTALLATION

A. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:
   1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile.

C. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

D. Comply with carpet cushion manufacturer's written recommendations.

3.6 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
   2. Remove yarns that protrude from carpet surface.
   3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet and carpet adhesive manufacturer.

D. Replace damaged carpet at no additional cost to the Owner.

E. At completion of the Work when directed by Owner, remove covering and vacuum clean and remove any soiling to the satisfaction of Owner.

F. Remove rubbish, wrapping paper and salvages from the project site. Turn over excess pieces of usable carpet to Owner for future repairs.

END OF SECTION

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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. Steel.
   2. Galvanized metal.

B. Related Requirements:
   1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
   2. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
   3. Division 09 Section “High Performance Coatings” for surface preparation and the application of high performance coatings.

C. Paint exposed surfaces, except where the paint schedules indicate that a surface receives another coating, material is not to be painted or is to remain natural. If paint schedules do not specifically mention an item or a surface, paint item or surface same as similar adjacent materials or surfaces whether or not schedules indicate colors. If schedules do not indicate color or finish, Architect will select from standard colors and finishes available.

D. Do not paint prefinished items, finished metal surfaces, operating parts, and labels.
   1. Prefinished items include following factory-finished components:
      a. Prefinished Metal wall, soffit and roof panels.
      b. Prefinished flashings and copings.
      c. Finished mechanical and electrical equipment.
      d. Light fixtures.
   2. Finished metal surfaces include following:
      a. Anodized aluminum.
      b. Stainless steel.
      c. Chromium plate.
      d. Copper.
      e. Bronze and brass.
   3. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
   4. Concrete Masonry and Concrete, unless painting is indicated.
   5. Brick masonry.

1.2 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.
6. Low-Luster refers to Eggshell, and Satin as defined above.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
1. Submit Samples on rigid backing, 200 mm (8 inches) square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. 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 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: 5 percent, but not less than 3.8 L (1 gal.) of each material and color applied.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a 5 year record of successful in-service performance.

B. Source Limitations: Obtain primers and undercoat materials for each coating system from same manufacturer as finish coats.

C. 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 9 sq. m (100 sq. ft.).
b. Other Items: Architect will designate items or areas required.

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 to Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 7 deg C (45 deg F).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 10 and 35 deg C (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 3 deg C (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.
   2. Glidden Professional/Devoe Coatings
   3. PPG Architectural Finishes, Inc.
   4. Pratt & Lambert.
   5. Sherwin-Williams Company (The).

6. Tenemec.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:
1. 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. Verify compatibility with existing paint systems and materials.
2. 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.
3. 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. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

D. Colors: Provide custom colors of the finished paint systems to match the Architect's samples.

E. Lead: Provide paint containing no lead.

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.

D. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems using materials specified over substrates primed by others.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Provide all surface preparation as recommended by the paint manufacture, including cleaning of existing surfaces to be repainted.

C. 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.

D. 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.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 SURFACE PREPARATION OF PREVIOUSLY COATED SURFACES

A. General:
   1. Remove cracked and deteriorated sealants and calking.
   2. Remove chalk deposits and loose, blistered, peeling, scaling, or crazed finish to bare base material or sound substrate by scraping and sanding.
   3. Wash surfaces with solution of TSP to remove wax, oil, grease, and other foreign material; rinse, and allow to dry. Exercise caution that TSP solution does not soften existing coating.
   4. Abrade glossy surfaces by sanding or wiping with liquid de-glosser.
   5. Remove mildew as specified above.
   6. Test compatibility of existing coatings by applying new coating to small, inconspicuous area. If new coatings lift or blister existing coatings, provide test results and recommendations from paint manufacturer to Architect.
   7. Apply specified primer to surfaces scheduled to receive coatings.

B. Metal:
   1. Remove rust from surfaces to bare metal in accordance with SP3 "Power Tool Cleaning".
   2. Exercise care not to remove galvanizing.
   3. Complete preparation as specified for new work.

C. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

E. 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.

F. Aluminum Substrates: Remove loose surface oxidation.

G. Materials Preparation: 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.

3.4 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. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   5. 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.

3.5 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.

3.6 EXTERIOR PAINTING SCHEDULE

A. This schedule applies to exterior steel and galvanized steel, not indicated to receive a high performance coating.

B. Ferrous Metal, Semi-gloss, Exterior Alkyd-Enamel Finish: Primer is not required on shop-primed items; touch up shop primer where provided.
   1. Benjamin Moore:
      a. Prime Coat: Direct-to-Metal M24DTM.
      b. Intermediate: Same as prime coat.
      c. Top Coat: Same as intermediate coat.
   2. Sherwin-Williams:
      a. Prime Coat: Direct-to-Metal B55 Series.
      b. Intermediate: Same as prime coat.
      c. Top Coat: Same as intermediate coat.
   3. Glidden Professional/Devoe Coatings:
      a. Prime Coat: Devguard 4360 Low VOC Universal Primer.
      b. Intermediate Coat: Devguard 4306 Rust Preventative Semi-Gloss Enamel.
      c. Top Coat: Same as intermediate coat.

C. Zinc-Coated (Galvanized) Metal, Semi-gloss Exterior Alkyd-Enamel Finish: Primer is not required on shop-primed items; touch up shop primer where provided.
   1. Benjamin Moore:
      a. Prime Coat: Direct-to-Metal M24DTM.
      b. Intermediate: Same as prime coat.
      c. Top Coat: Same as intermediate coat.
   2. Sherwin-Williams:
      a. Prime Coat: Galvite Paint No. B50W3.
      b. Intermediate Coat: Direct-to-Metal B55 Series.
      c. Top Coat: Same as intermediate coat.
   3. Glidden Professional/Devoe Coatings:
      a. Prime Coat: Devguard 4360 Low VOC Universal Primer.
      b. Intermediate Coat: Devguard 4306 Rust Preventative Semi-Gloss Enamel.
      c. Top Coat: Same as intermediate coat.

END OF SECTION

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SECTION 09 91 23

INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:
   1. Concrete.
   2. Concrete masonry units (CMU).
   3. Steel.
   4. Galvanized metal.
   5. Aluminum (not anodized or otherwise coated).
   6. Wood.
   7. Gypsum board.
   8. Cotton or canvas insulation covering.
   9. All exposed surfaces that are not pre-finished shall be painted, including exposed mechanical and electrical items.
   10. This Section includes marking and identification of Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions.

B. Related Requirements:
   1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
   2. Division 09 painting Sections for high performance coatings.
   3. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

C. Paint exposed surfaces, in finished spaces except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If paint schedules do not specifically mention an item or a surface, paint item or surface same as similar adjacent materials or surfaces whether or not schedules indicate colors. If schedules do not indicate color or finish, Architect will select from standard colors and finishes available.
   1. Painting within tenant spaces is not included in the Work, unless otherwise indicated.
   2. Metal Stairs: Paint exposed surfaces including underside to match the existing stairs, as selected by the Architect.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
   1. Prefinished items include following factory-finished components:
      a. Architectural woodwork and casework.
      b. Wood doors.
      c. Metal lockers.
      d. Elevator entrance doors and frames.
      e. Elevator equipment.
      f. Finished mechanical and electrical equipment.

g. Light fixtures.
h. Distribution cabinets.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
   a. Furred areas.
   b. Ceiling plenums.
   c. Utility tunnels.
   d. Pipe spaces.
   e. Duct shafts.
   f. Elevator shafts.
3. Finished metal surfaces include following:
   a. Anodized aluminum.
   b. Stainless steel.
   c. Chromium plate.
   d. Copper.
   e. Bronze and brass.
4. Operating parts include moving parts of operating equipment and the following:
   a. Valve and damper operators.
   b. Linkages.
   c. Sensing devices.
   d. Motor and fan shafts.
5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.2 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
   2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
   3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
   4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
   5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.
   6. Low-Luster refers to Eggshell, and Satin as defined above.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches (200 mm) square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

C. 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 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: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a 5 year record of successful in-service performance.

B. Source Limitations: Obtain primers and undercoat materials for each coating system from same manufacturer as finish coats.

C. 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 9 sq. m (100 sq. ft.).
      b. Other Items: Architect will designate items or areas required.
   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 to Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.

8. VOC content.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 7 deg C (45 deg F).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 10 and 35 deg C (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 3 deg C (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.
   2. Glidden Professional/Devoe Coatings.
   3. Pittsburgh Paint.
   4. PPG Architectural Finishes, Inc.
   5. Pratt & Lambert.
   6. Sherwin-Williams Company (The).
   7. Rust-Oleum.
   8. Vista Paint Corporation.
   9. Kelly-Moore.
   10. H&C; Concrete.
   11. AFM Safecoat.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, verify compatibility with existing paint systems and materials, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. 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.

3. 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. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Provide custom colors of the finished paint systems to match the Architect's samples.

2.3 PAINT ADDITIVES

A. Anti-Slip Additive: Rust-oleum Marine Coating Anti-Slip additive, or a comparable product by the manufacturer of the paint used.

2.4 PAINT SCHEDULE

A. Refer to Schedule at end of Part 3 of this Section.

2.5 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Plaster: 12 percent.
5. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

F. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   1. Notify Architect about anticipated problems using materials specified over substrates primed by others.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Provide all surface preparation as recommended by the paint manufacture, including cleaning of existing surfaces to be repainted.

C. 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.

D. 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.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 SURFACE PREPARATION OF PREVIOUSLY COATED SURFACES

A. General:
   1. Remove cracked and deteriorated sealants and calking.
   2. Remove chalk deposits and loose, blistered, peeling, scaling, or crazed finish to bare base material or sound substrate by scraping and sanding.
   3. Wash surfaces with solution of TSP to remove wax, oil, grease, and other foreign material; rinse, and allow to dry. Exercise caution that TSP solution does not soften existing coating.
   4. Abrade glossy surfaces by sanding or wiping with liquid de-glosser.
   5. Remove mildew as specified above.

6. Test compatibility of existing coatings by applying new coating to small, inconspicuous area. If new coatings lift or blister existing coatings, provide test results and recommendations from paint manufacturer to Architect.
7. Apply specified primer to surfaces scheduled to receive coatings.

B. Metal:
1. Remove rust from surfaces to bare metal in accordance with SP3 "Power Tool Cleaning".
2. Exercise care not to remove galvanizing.
3. Complete preparation as specified for new work.

C. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

E. 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.

F. Aluminum Substrates: Remove loose surface oxidation.

G. Materials Preparation: 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.

3.4 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. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. 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. Lightweight and regular concrete masonry that is coated with an epoxy shall have a pinhole free surface at finish.

E. 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.
      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.

3.5 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.

3.6 FIRE WALL MARKING AND IDENTIFICATION

A. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions:
   1. Stenciling:
      a. "FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS."
   2. Size: 2 ½ inches tall.
   3. Location:
      a. In accessible concealed floor, floor-ceiling spaces.
      b. Both sides of walls, 20 feet on center maximum on and at least one message for each room.
   4. Exception: Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

3.7 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces: Eggshell Acrylic Enamel Finish.
   1. Benjamin Moore:

a. Prime Coat Coat-Smooth Surfaces: Fresh Start All-Purpose 100% Acrylic Primer.
b. Prime coat at sand blasted or porous concrete: Moorcraft Super Craft Latex Block Filler 285.
c. Intermediate Coat: Interior latex matching topcoat.
d. Topcoat: Regal Premium Interior 100% Acrylic Eggshell Finish N319.

2. Sherwin Williams:
a. Prime Coat Coat-Smooth Surfaces: Loxon Concrete & Masonry Primer, A24W8300.
b. Prime coat at sand blasted or porous concrete: PrepRite Block Filler B25W25.
c. Intermediate Coat: Interior latex matching topcoat.
d. Topcoat: ProMar 400 Zero VOC Interior Latex Eg-Shel, B20W4600 Series.

3. Glidden Professional:
a. Prime Coat-Smooth Surfaces: Concrete Coatings Bond-Prep Pigmented Bonding Primer #3030-1200.
b. Prime coat at sand blasted or porous concrete: Concrete Coatings Block Filler Interior Exterior Primer #3010-1200.
c. Intermediate Coat: Interior latex matching topcoat.
d. Topcoat: Ultra-Hide 150 Interior Eggshell #1412V.

B. Concrete Substrates, Nontraffic Surfaces: Flat Acrylic Enamel Finish.
1. Benjamin Moore:
a. Prime Coat Coat-Smooth Surfaces: Fresh Start All-Purpose 100% Acrylic Primer.
b. Prime coat at sand blasted or porous concrete: Moorcraft Super Craft Latex Block Filler 285.
c. Intermediate Coat: Interior latex matching topcoat.
d. Topcoat: Regal Premium Interior 100% Acrylic Flat Finish W215.

2. Sherwin Williams:
a. Prime Coat Coat-Smooth Surfaces: Loxon Concrete & Masonry Primer, A24W8300.
b. Prime coat at sand blasted or porous concrete: PrepRite Block Filler B25W25.
c. Intermediate Coat: Interior latex matching topcoat.
d. Topcoat: ProMar 400 Zero VOC Interior Latex Flat, B30W04650 Series.

3. Glidden Professional:
a. Prime Coat-Smooth Surfaces: Concrete Coatings Bond-Prep Pigmented Bonding Primer #3030-1200.
b. Prime coat at sand blasted or porous concrete: Concrete Coatings Block Filler Interior Exterior Primer #3010-1200.
c. Intermediate Coat: Interior latex matching topcoat.
d. Topcoat: Ultra-Hide 150 Interior Flat Paint # 1210-XXXXV.

C. Concrete Substrates, Nontraffic Surfaces: Sealer/Stain:
1. H&C; Concrete:
a. Top coat: H&C® Paver Sealer Natural Look Water Based.

D. CMU Substrates: Eggshell Acrylic Enamel Finish.
1. Benjamin Moore:
a. Prime coat: Moorcraft Super Craft Latex Block Filler 285.

b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Regal Premium Interior 100% Acrylic Eggshell Finish N319.

2. Sherwin Williams:
   a. Prime coat: PrepRite Block Filler B25W25.
   b. Intermediate Coat: Interior latex matching topcoat.
   c. Topcoat: ProMar 400 Zero VOC Interior Latex Eg-Shel, B20W4600 Series.
3. Glidden Professional:
   a. Prime Coat: Concrete Coatings Block Filler Interior Exterior Primer #3010-1200.
   b. Intermediate Coat: Interior latex matching topcoat.
   c. Topcoat: Ultra-Hide 150 Interior Eggshell #1412V.

E. CMU Substrates: Semi-Gloss Epoxy.
1. Benjamin Moore:
   a. Prime coat: Fresh Start® All-Purpose 100% Acrylic Primer (N023)
   b. Intermediate Coat: Water-based Epoxy matching top coat.
   c. Topcoat: Super Spec® Acrylic Epoxy Coating Semi-Gloss 256
2. Sherwin Williams:
   a. Prime coat: Loxon Block Surfacer
   b. Intermediate Coat: Water-based Epoxy matching topcoat.
   c. Topcoat: Pro Industrial™ Zero VOC Catalyzed Acrylic Epoxy, B73-300 Series
3. Glidden Professional/Devoe Coatings
   a. Prime coat: Tru-Glaze-WB 4015.
   b. Intermediate Coat: Water-based Epoxy matching topcoat.
   c. Topcoat: Water-based Epoxy Finish, Tru-Glaze-WB 4426.

F. Steel Substrates: Semi-Gloss Latex Enamel.
1. Benjamin Moore:
   a. Prime Coat: Super Spec HP Acrylic Metal Primer P04.
   b. Intermediate Coat: Interior acrylic matching topcoat.
   c. Topcoat: Moorcraft Super Spec 100% Acrylic Semi-Gloss Enamel 281.
2. Sherwin Williams:
   a. Prime Coat: Pro Industrial Pro-Cryl Universal Primer B66-310.
   b. Intermediate Coat: Interior acrylic matching topcoat.
   c. Topcoat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series.
3. Glidden Professional/Devoe Coatings:
   a. Prime Coat: Devflex 4020PF Direct to Metal Primer & Flat Finish.
   b. Intermediate Coat: Interior latex matching topcoat
   c. Topcoat: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss.

G. Galvanized-Metal Substrates: Semi-Gloss Latex Enamel.
1. Benjamin Moore:
   a. Prime Coat: Super Spec HP Acrylic Metal Primer M04.
   b. Intermediate Coat: Interior acrylic matching topcoat.
   c. Topcoat: Moorcraft Super Spec 100% Acrylic Semi-Gloss Enamel 281.
2. Sherwin Williams:
   a. Prime Coat: Pro Industrial Pro-Cryl Universal Primer B66-310.
   b. Intermediate Coat: Interior acrylic matching topcoat.

c. Topcoat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series.

3. Glidden Professional/Devoe Coatings:
   a. Prime Coat: Devflex 4020PF Direct to Metal Primer & Flat Finish.
   b. Intermediate Coat: Interior latex matching topcoat
   c. Topcoat: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss.

H. Aluminum Substrates (Not anodized or pre-finished): Semi-Gloss Latex Enamel.
1. Benjamin Moore:
   a. Prime Coat: Super Spec HP Acrylic Metal Primer M04.
   b. Intermediate Coat: Interior acrylic matching topcoat.
   c. Topcoat: Moorcraft Super Spec 100% Acrylic Semi-Gloss Enamel 281.
2. Sherwin Williams:
   a. Prime Coat: Pro Industrial Pro-Cryl Universal Primer B66-310.
   b. Intermediate Coat: Interior acrylic matching topcoat.
   c. Topcoat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series.
3. Glidden Professional/Devoe Coatings:
   a. Prime Coat: Devflex 4020PF Direct to Metal Primer & Flat Finish.
   b. Intermediate Coat: Interior acrylic matching topcoat
   c. Topcoat: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss.

I. Gypsum Board Wall Substrates: Eggshell Acrylic Enamel Finish.
1. Benjamin Moore:
   a. Prime coat: Regal Premium Interior latex Primer N216.
   b. Intermediate Coat: Interior latex matching topcoat.
   c. Topcoat: Regal Premium Interior 100% Acrylic Eggshell Finish N319.
2. Sherwin Williams:
   a. Prime coat: Drywall Primer, B28W8100.
   b. Intermediate Coat: Interior latex matching topcoat.
   c. Topcoat: ProMar 400 Zero VOC Interior Latex Eg-Shel, B20W4600 Series.
3. Glidden Professional:
   a. Prime coat: High Hide Interior Primer Sealer #1000-1200.
   b. Intermediate Coat: Interior latex matching topcoat.
   c. Topcoat: Ultra-Hide 150 Interior Eggshell #1412V.

J. Gypsum Board Ceiling Substrates: Flat Acrylic Enamel Finish.
1. Benjamin Moore:
   a. Prime coat: Regal Premium Interior latex Primer N216.
   b. Intermediate Coat: Interior latex matching topcoat.
   c. Topcoat: Regal Premium Interior 100% Acrylic Flat Finish N215.
2. Sherwin Williams:
   a. Prime coat: Drywall Primer, B28W8100.
   b. Intermediate Coat: Interior latex matching topcoat.
   c. Topcoat: ProMar 400 Zero VOC Interior Latex Flat, B30W4600 Series.
3. Glidden Professional:
   a. Prime coat: High Hide Interior Primer Sealer #1000-1200.
   b. Intermediate Coat: Interior latex matching topcoat.
   c. Topcoat: Ultra-Hide 150 Interior Flat #1210.

K. Glass-mat Gypsum Board Bathroom Wall and Ceiling Substrates: Mold Resistant Eggshell Acrylic Enamel Finish.
   1. Benjamin Moore:
      a. Prime coat: Interior latex matching topcoat
      b. Intermediate Coat: Interior latex matching topcoat.
      c. Topcoat: Regal Premium Select Interior Eggshell 549.
   2. Sherwin Williams:
      a. Prime coat: Interior latex matching topcoat.
      b. Intermediate Coat: Interior latex matching topcoat.
      c. Topcoat: EMERALD Acrylic Interior/Exterior Latex, Matte, K36 Series.
   3. Glidden Professional:
      a. Prime coat: Interior latex matching topcoat.
      b. Intermediate Coat: Interior latex matching topcoat.
      c. Topcoat: Diamond interior 100% acrylic interior eggshell paint + primer

L. Gypsum Board Substrates: Semi-Gloss Epoxy Finish.
   1. Benjamin Moore:
      a. Prime Coat: Waterborn Acrylic Epoxy M08/M09.
      b. Intermediate Coat: Epoxy matching topcoat.
      c. Topcoat: Industrial Maintenance Coatings; Acrylic Epoxy Coating M43/M44.
   2. Sherwin Williams:
      a. Prime Coat: PrepRite 200 Latex Wall Primer B28W200 Series..
      b. Intermediate Coat: Epoxy matching topcoat.
      c. Topcoat: Pro Industrial HB/ Waterbased Epoxy, B71W111/B71W110 Series.
   3. Glidden Professional:
      a. Prime coat: Prep & Prime Gripper 3210.
      b. Intermediate Coat: Interior latex matching topcoat.
      c. Topcoat: TRU-GLAZE-WB 4406 Waterborne Epoxy Semi-Gloss Coating.

M. Wood/Plywood Substrates: Semi-gloss Alkyd Enamel.
   1. Benjamin Moore:
      a. Prime Coat: Moorecraft Super Spec Alkyd Enamel Undercoater & Primer Sealer C245.
      b. Intermediate Coat: Interior alkyd matching topcoat.
      c. Topcoat: Super Hide Alkyd Semi-Gloss Enamel 280.
   2. Sherwin Williams:
      a. Prime Coat: Premium Wall and Wood Primer B28W8100.
      b. Intermediate Coat: Interior alkyd matching topcoat.
      c. Topcoat: ProClassic XP Interior Alkyd Semi-Gloss, B34W8551.
   3. Glidden Professional:
      a. Prime Coat: Gripper Interior/Exterior Primer Sealer 3210-1200..
      b. Intermediate Coat: Interior alkyd matching topcoat.
      c. Topcoat: Lifemaster Oil Int/Ext Semi-Gloss #1506..

N. Black Enamel Finish: Duct throats for 24 inches behind air return grills and wood blocking exposed at reveals. Flat Acrylic Finish.
   1. Benjamin Moore:
      a. Topcoat: Regal Premium Interior 100% Acrylic Flat Finish N215.
   2. Sherwin Williams:
      a. Topcoat: ProMar 400 Zero VOC Interior Latex Flat, B30W4600 Series.

3. Glidden Professional:
   a. Topcoat: Ultra-Hide 150 Interior Flat Black #1210-9990.
4. Color: Black.

END OF SECTION

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SECTION 09 96 00

HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and application of high-performance coating systems on the following substrates:
   1. Exterior Substrates:
      a. Steel.
      b. Galvanized steel.

B. Related Sections include the following:
   1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
   2. Division 09 painting Sections for general field painting.

1.2 ACTION SUBMITTALS

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

B. Samples for Verification: For each type of coating system and in each color and gloss of finish coat indicated.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

C. Samples for Warranty Verification: For each type of coating system and in each color and gloss of finish coat indicated.
   1. Submit sample sets to Manufacturer, Owner, and Contractor.

D. Product List: For each product indicated. Cross-reference products to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.3 QUALITY ASSURANCE

A. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and coating systems indicated.

B. Mockups: Apply benchmark samples of each coating system indicated 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 type of coating and substrate.
      a. Stair stringer, risers and guardrail: Provide samples of at least one stair run.

b. Other Items: Architect will designate items or areas required.

2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
3. Final approval of color selections will be based on benchmark samples.
   a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.4 WARRANTY

A. Special Finish Warranty: Standard form in which manufacturer and applicator jointly agrees to repair finishes or replace finish that shows evidence of deterioration of shop-applied finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

   2. Warranty Period: 15 years from date of Substantial Completion.
   3. Manufacturer is to verify color selected is qualified for Warranty.

1.5 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.

1.6 PROJECT CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F.

B. Do not apply coatings 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.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
   1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with the requirements, provide products listed by Tnemec Company Inc.

2.2 HIGH-PERFORMANCE COATINGS

A. Material Compatibility:
   1. Provide materials for use within each coating 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.
   2. Provide products of same manufacturer for each coat in a coating system.

B. Colors: Match Architect's samples.

2.3 METAL PRIMERS

A. Primer for shop application: Zink-Rich Aromatic Urethane primer applied at spreading rate recommended by manufacturer.
   1. Tnemec: Series 94-H2O Hydro-Zinc; 2.5-3.5 mils DFT,.

2.4 EPOXY INTERMEDIATE COAT

A. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer.
   1. Tnemec: Series 27WB Typoxy; DFT: 4.0 to 6.0 mils,.

2.5 FLUOROPOLYMER TOPCOAT

A. Topcoat: Gloss Metallic or Pearlescent Fluoropolymer enamel applied at spreading rate recommended by manufacturer.
   1. Tnemec: Series 1078V Fluoronar Metallic; DFT: 2.0 to 3.0 mils,.

B. Clear Coat: Gloss Un-Pigmented Fluoropolymer enamel applied at spreading rate recommended by manufacturer.
   1. Tnemec: Series 1078V Fluoronar Metallic; DFT: 2.0 to 3.0 mils,.

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 work.
   1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   2. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

3. Coating application indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

C. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.

D. Steel Substrates: Remove rust and loose mill scale.
1. Surface Preparation: Abrasive blast in accordance with SSPC-SP6 with a minimum angular anchor profile of 2.0 mils.

E. Galvanized Steel Substrates: Visible deposits of oil, grease, or other contaminants shall be removed as required by SSPC-SP1. Sweep (Abrasive) Blasting per SSPC-SP16 to achieve a uniform anchor profile (1.0 to 2.0 mils). Galvanized surfaces must be clean, dry, and contaminant free prior to application of coatings.

3.3 APPLICATION

A. Location and method of application:
1. Shop application by spray is preferred.
2. Field application by spray is accepted. Field application by other methods approved by the Manufacturer may be accepted by the Architect based on reference samples.

B. Apply high-performance coatings according to manufacturer's written instructions.
1. Use applicators and techniques suited for coating and substrate indicated.

C. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

D. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

E. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

F. Metallic Finish Application: Apply metallic finished according to Manufacturer's Metallic Finish Application Instructions. Apply to provide a uniform metallic appearance, on multiple surfaces.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:
   1. Owner will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will perform tests for compliance with specified requirements.
   3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, 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 coated surfaces.

3.6 HIGH-PERFORMANCE COATING SCHEDULE

A. Exterior Steel Substrates:
   1. Polyurethane, Pigmented, Over Epoxy Coating System:
      a. Prime Coat: Zink rich primer.
      b. Intermediate Coat: Epoxy.
      c. First Topcoat: Fluoropolymer, two-component, pigmented, full-gloss metallic, or semi-gloss.
      d. Second Topcoat: Same as first coat.
      e. Clear coat: Fluoropolymer, two-component, un-pigmented.
      f. Colors and gloss: Match Architect's samples, Provide semi-gloss, or full-gloss metallic, as indicated.
   2. Substrates include but are not limited to:
      a. Exterior exposed Structural-Steel, Architecturally Exposed Structural Steel and steel fabrications.
      b. Exterior steel indicated to receive High Performance Coating.

B. Exterior Galvanized Steel Substrates:
   1. Polyurethane, Pigmented, Over Epoxy Coating System:
      a. Prime Coat: Omit prime coat, prepare galvanizing for intermediate coat.
      b. Intermediate Coat: Epoxy.
      c. First Topcoat: Fluoropolymer, two-component, pigmented, semi-gloss.
      d. First Topcoat: Fluoropolymer, two-component, pigmented, full-gloss metallic, or semi-gloss.
      e. Second Topcoat: Same as first coat.
      f. Clear coat: Fluoropolymer, two-component, un-pigmented.
      g. Colors and gloss: Match Architect's samples, Provide semi-gloss, or full-gloss metallic, as indicated.
   2. Substrates include but are not limited to:
      a. Supports for exterior screens.
      b. Exterior exposed Galvanized Structural-Steel, Galvanized Architecturally Exposed Structural Steel and Galvanized steel fabrications.
      c. Exterior galvanized steel indicated to receive High Performance Coating.

END OF SECTION

SECTION 10 14 23

POST AND PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Panel signs.
2. Nonilluminated post-and-panel signs.

B. Related Requirements:
1. Section 01 50 00 "Temporary Facilities and Controls" for temporary Project identification signs and for temporary informational and directional signs.
2. Section 03 30 00 "Cast-in-Place Concrete" for concrete foundations, concrete fill in postholes, and setting anchor bolts in concrete foundations for signs.

1.2 COORDINATION

A. Furnish templates and tolerance information for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signage.
1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly, showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
1. Panel and Post-and-Panel Signs: Full-size Sample.
2. Exposed Accessories: Full-size Sample of each accessory type.
3. Full-size Samples, if approved, will be returned to Contractor for use in Project.

E. Product Schedule: For post-and-panel and pylon signs. Use same designations indicated on Drawings or specified.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.5 QUALITY ASSURANCE

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

1.6 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Deterioration of embedded graphic image.
      c. Separation or delamination of sheet materials and components.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" the ABA standards of the Federal agency having jurisdiction, ICC A117.1.

2.2 PANEL SIGNS

A. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
   1. Solid-Sheet Sign: Aluminum sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph and as follows:
      a. Thickness: As indicated on Drawings.
      b. Surface-Applied, Flat Graphics: As indicated on Drawings.
   2. Sign-Panel Perimeter: Finish edges smooth.
      a. Edge Condition: Square cut.
      b. Corner Condition in Elevation: As indicated on Drawings.
   3. Mounting: As indicated on Drawings.
   4. Sign-Panel-Face Finish and Applied Graphics:
      a. Baked-Enamel or Powder-Coat Finish and Graphics: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
   5. Text and Typeface: As indicated on Drawings.

2.3 POST-AND-PANEL SIGNS

A. Post-and-Panel Sign: Sign of single-panel configuration; with smooth, uniform surfaces and support assembly; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
   1. Solid-Sheet Sign Panels: Aluminum sheet with finish specified in "Sign-Panel-Face Finish and Applied Graphics" Subparagraph and as follows:
      a. Thickness: As indicated on Drawings.
      b. Surface-Applied Graphics: Applied baked enamel or powder coat.
   2. Sign-Frame Mounting: As indicated on Drawings.
   3. Posts: Steel.
      a. Shape: As indicated on Drawings.
      b. Size As indicated on Drawings.
      c. Installation Method: Baseplate.
      d. Finish and Color: As indicated on Drawings.
   4. Sign-Panel-Face Finish and Applied Graphics:
      a. Baked-Enamel or Powder-Coat Finish and Graphics: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
   5. Text and Typeface: As indicated on Drawings.

2.4 MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Steel Materials:
   1. Steel Tubing or Pipe: ASTM A 500/A 500M, Grade B.

C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.5 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:
   1. Use concealed fasteners and anchors unless indicated to be exposed.
   2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
   3. Exposed Metal-Fastener Components, General:
      a. Fastener Heads: For nonstructural connections, use screws and bolts with tamper-resistant, one-way-head slots unless otherwise indicated.
   4. Inserts: Furnish inserts to be set by other installers into concrete or masonry work.

B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to

authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC193 ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing signs with imposed loads to structure.
2. Type: Torque-controlled, expansion anchor torque-controlled, adhesive anchor or adhesive anchor.
3. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.6 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in locations concealed from view after final assembly.
2. Mill joints to tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of flux, and dress exposed and contact surfaces.
4. Conceal fasteners and anchors unless indicated to be exposed; locate exposed fasteners where they will be inconspicuous.
5. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.

B. Sign Message Panels: Construct sign-panel surfaces to be smooth and to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.

1. Coordinate dimensions and attachment methods to produce message panels with closely fitting joints. Align edges and surfaces with one another in the relationship indicated.
2. Increase panel thickness or reinforce with concealed stiffeners or backing materials as needed to produce surfaces without distortion, buckles, warp, or other surface deformations.
3. Continuously weld joints and seams unless other methods are indicated; grind, fill, and dress welds to produce smooth, flush, exposed surfaces with welds invisible after final finishing.

C. Post Fabrication: Fabricate posts designed for structural performance indicated and of lengths required for installation method indicated for each sign.

1. Steel Posts: Fabricate from steel tubing unless otherwise indicated. Include post caps, fillers, spacers, junction boxes, access panels, reinforcement where required for loading conditions, and related accessories required for complete installation.
   a. Hot-dip galvanize post assemblies after fabrication according to ASTM A 123/A 123M.

2. Baseplates: Fabricate posts with baseplates welded to bottom of posts. Drill holes in baseplate for anchor-bolt connection.
   a. Provide drilled-in-place anchor bolts of size required for connecting posts to concrete foundations.

2.7 GENERAL FINISH REQUIREMENTS

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

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.8 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

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. Verify that sign-support surfaces are within tolerances to accommodate signs.

C. Verify that anchorage devices embedded in permanent construction are correctly sized and located to accommodate signs.

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

3.2 INSTALLATION

A. General: Install signs using installation methods indicated and according to manufacturer's written instructions.
   1. Install signs level, plumb, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Install signs so they do not protrude or obstruct according to the accessibility standard.
   3. Before installation, verify that sign components are clean and free of materials or debris that would impair installation.

4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Accessible Signage: Install in locations on walls as indicated on Drawings and according to the accessibility standard.

C. Mounting Methods:
1. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

3.3 INSTALLING POSTS

A. Vertical Tolerance: Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).

B. Baseplate Method:
1. Preset Anchor Bolts: Set post baseplate in position over anchor bolts projecting from concrete foundation, shim and support post to prevent movement, place washers and nuts, and tighten. Fill shim space with nonshrink, nonmetallic grout, mixed and placed to comply with manufacturer's written instructions.
2. Drilled-in-Place Anchor Bolts: Set post baseplate in position over concrete foundation, locate and drill anchor holes, shim and support post to prevent movement, place washers and anchor bolts, and tighten. Fill shim space with nonshrink, nonmetallic grout, mixed and placed to comply with manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 10 44 00

FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Portable fire extinguishers.
2. Fire-protection cabinets for the following:
a. Portable fire extinguishers.
3. Fire-protection accessories.

B. Related Sections include the following:
1. Division 09 Section "Painting" for field-painting fire-protection cabinets.

1.2 PERFORMANCE REQUIREMENTS

A. Accessibility: Comply with 36 CFR, Part 1191, the Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines (ADA/ABAAG) and Section 504 of the Rehabilitation Act of 1973, as amended, which generally requires non-discrimination against physically impaired persons.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
1. Fire Extinguishers: Include rating and classification.
2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Portable Fire Extinguishers:
      a. General Fire Extinguisher Corporation.
      b. J.L. Industries, Inc.
      c. Kidde: Walter Kidde, The Fire Extinguisher Co.
      d. Larsen's Manufacturing Company.
      e. Tyco SimplexGrinnell
      f. Watrous; Div. of American Specialties, Inc.
   2. Fire-Protection Cabinets:
      a. General Accessory Manufacturing Co.
      b. J.L. Industries, Inc.
      c. Larsen's Manufacturing Company.
      d. Tyco SimplexGrinnell
      e. Watrous; Div. of American Specialties, Inc.

B. Basis of Design Products: Subject to compliance with requirements, provide the products matching the existing or comparable products from a listed manufacturer.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.

2.3 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

B. Multipurpose Dry-Chemical Type: UL-rated 4-A:80-B:C, 10-lb nominal capacity, in enameled-steel container.

2.4 FIRE-PROTECTION CABINETS [**FEC-01**]

A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
   1. Cabinet Metal: Stainless-steel sheet.

B. Cabinet Type: Suitable for the following:
   1. 10 lb. Fire extinguisher.

C. Cabinet Mounting: Suitable for the following mounting conditions:
   1. Surface mounted.

D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

E. Cabinet Trim Material: Manufacturer's standard, as follows:
   1. Stainless-steel sheet.

F. Door Material: Manufacturer's standard, as follows:

1. Stainless-steel sheet.

G. Door Style: Manufacturer's standard design, as follows:
1. Acrylic bubble.

H. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.
1. Provide minimum 1/2-inch- thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.

I. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

2.5 ACCESSORIES

A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.

2.6 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
1. Run grain of directional finishes with long dimension of each piece.

C. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
1. Remove and replace damaged, defective, or undercharged units.

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

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at a uniform height acceptable to authorities having jurisdiction.
1. Fasten mounting brackets to structure and cabinets, square and plumb.

2. Fasten cabinets to structure, square and plumb.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

3.4 FIRE-PROTECTION SCHEDULE

A. Fire Extinguisher **FE**: Where this designation is indicated, provide fire extinguisher on wall bracket complying with the following:
   1. Portable Fire Extinguisher: Larsen's MP10 (4A-80BC).
   2. Mounting bracket: Larsen's B-2.

B. Fire-Protection Cabinet **FEC-01**: Where this designation is indicated, provide fire-protection cabinet, and fire extinguisher complying with the following:
   1. Products: Larsen's, 27 x 9.5 Inch Vista Series Cabinet for up to 10 Lbs ABC Fire Extinguisher - Stainless Steel Door and Frame, Surface Mount, or comparable product.
   2. Cabinet Material: Stainless-steel sheet.
   3. Type: Fire extinguisher.
   4. Mounting: Surface.
   5. Door Material: Stainless-steel sheet.
   6. Door Glazing: Acrylic bubble.
   7. Accessories:
      a. Mounting brackets, 546.
      b. Door locks.
   8. Color and Texture:
      a. Stainless-steel sheet Finish: #4 polish.
   9. Portable Fire Extinguisher: Larsen's MP10 (4A-80BC).

END OF SECTION

SECTION 10 44 45

PHOTOLUMINESCENT EXIT PATH MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Photoluminescent exit path markings, including installation accessories for the following:
   1. Stair tread and landing edge nosings.
   2. Handrail illumination strips.
   3. Perimeter illumination strips.
   4. Demarcation Way Finding Strips
   5. Obstacle Marker illumination strips.
   6. Door Signage and Directional Signage
   7. Door hardware markings illumination strips.
   8. Door frame marking illumination strips.

B. Related Sections:
   1. Division 05 Sections "Metal Stairs" for metal stairs and handrails, and for installation of nosing and perimeter strips.

1.2 PERFORMANCE REQUIREMENTS

A. Photoluminescent Exit Path Marking System shall be a complete system of low level way finding materials consisting of door signs, stair nosing strips, leading edge nosing strips, handrail illumination strips, demarcation way finding strips, obstacle markers and directional signs.

B. Stair Tread and Landing Edge Nosings:
   1. Provide photoluminescent strips not less 1 inch (25 mm) wide forming an integral part of the leading edge of stair treads and landings.
   2. Provide mechanical fasteners used to anchor stair and landing nosing to the substrate.
   3. Provide stair tread and landing nosing abrasive filled or having a serrated surfaces to improve slip resistance.
   4. Provide stair tread and landing nosing tread surfaces slip resistant as defined in ADA recommendations.
   5. Provide stair tread and landing nosing meeting OSHA Barrier-Free Code requirements for stairs.
   6. Provide stair tread and landing nosing tread surfaces slip resistant as defined in 2010 CBC

C. Photoluminescent handrail Illumination Strip shall be 1 inch wide; adhered to the handrail with a factory approved adhesive.

D. Photoluminescent Demarcation Way Finding Strip shall be 1 inch wide; adhered to the floor with a factory approved adhesive.

E. Photoluminescent Obstacle Markers 1 inch wide; with a pattern of 2 inch photoluminescent strips alternating with 2 inch black bands angled at 45 degrees adhered to all obstacles as defined by the established code.

F. Directional and Door Signs as a minimum shall be in compliance with IBC 1024 codes.

G. Stairwell Floor Identification Signage must meet IBC 1024 dimensional and informational requirements consisting of:

H. Photoluminescent Exit Path Marking System shall be tested and listed with an independently recognized test laboratory and comply with UL 1994.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of exit pathway marking indicated, including material description and installation instructions.

B. Shop drawings: Submit shop drawings showing complete installation details for photoluminescent exit path marking system, including required anchorage to surrounding construction.

C. Samples: Minimum 6 inch (150 mm) long samples of each specified item

1.4 INFORMATIONAL SUBMITTALS

A. Qualifications Data: For Installer.

B. Warranties: Signed copies of warranty of terms specified.

1.5 QUALITY ASSURANCE

A. Codes and Standards: copy with the applicable portions of the following:
1. 2009 International Building Code: Section 1024: Luminous Egress Path Markings
2. ASTM E 2072, Standard Specification for Photoluminescent (Phosphorescent) Safety Markings.
3. ASTM E 2073, Standard Test Method for Photopic Luminance of Photoluminescent (Phosphorescent) Markings.

B. Installer’s Qualifications: Installer: Firm with not less than three (3) years of successful experience in the installation of exit patheway markings similar to those required by this project and acceptable to the manufacturer of the system.

C. Source limitations: Obtain photoluminescent exit pathway marking products through one source from a single manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT/SITE CONDITIONS

A. Field Measurements: Verify field measurements before preparation of Shop Drawings and before fabrication to ensure proper fitting. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 WARRANTY

A. Provide manufacturer's written warranty stating that the photoluminescent exit path markings and associated and accessories will be free of defects in workmanship and materials in accordance with the General Conditions, except the warranty period is to be for three (3 years instead of one (1) year.

B. Provide signed warranty and submit copies to the Architect.

C. The above warranties are in addition to, and not a limitation of, other rights the Owner may under the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with the requirements, provide products by f the following:
1. Zero International, Bronx, NY 10455.
2. Everglow NA, Inc., Mathews, NC 28106
3. Balco, Inc., Wichita, KS 67217
4. Ecoglo, Access Products Inc., Buffalo, NY 14203
5. Nystrom.

2.2 MATERIALS

A. Aluminum: ASTM B 221, alloy 6063-T5 for extrusions

B. Photoluminescent: Phosphorescent pigment, combined with a carrier/fixer that is cross-linked to an aluminum substrate at high temperature. Conforming to the following requirements:
1. UL 1994: Pass
2. ASTM E 2072, as modified by IBC Section 1024
3. UV Degradation: 2000 hours when tested in accordance with ASTM G155.
4. Salt Spray resistance: ASTM B117.
5. Cleaning Test: ASTM D4820, pass.
6. Rate of Burning: ASTM D635, comply.
7. Surface Flammability: ASTM E162
8. Toxicity Testing: Bombardier SMP800-C “Toxic Gas Generation Test”.
9. Radioactivity Test: ASTM D3648.

C. Abrasive: Two (2) part Epoxy combined with aluminum oxide grit.

D. Fasteners required for complete installation to manufacturer's instructions.

E. Handrail Illumination Strips: Photoluminescent strip 1 inch wide, designed for use on and adhering to handrails with a factory applied pressure sensitive adhesive.

F. Perimeter Illumination Strips: Photoluminescent strip 1 inch wide, aluminum strips with ceramic coating designed for use on medium traffic landings and floor surfaces with a factory applied pressure sensitive adhesive.

G. Wall door and hardware illumination strips: Photoluminescent strip 1 inch wide, designed for use on and adhering to walls and doors with a factory applied pressure sensitive adhesive.

2.3 PRODUCTS

A. Photo-luminescent stair tread and landing nosings:
1. Nystrom; STSB-C4E, cast-in.
   a. CHANNEL: Extruded Aluminum
   b. APPLICATION: Poured Concrete, Steel Pan, Terrazzo.
   c. TREAD: Ribbed Bar Abrasive.
   d. WIDTH: 4 inches.
   e. MOUNTING: Extruded Anchor.

B. Photo-luminescent stair tread and landing nosings for existing stairs:
1. Nystrom; STRB-V4D, surface applied.
   a. CHANNEL: Extruded Aluminum
   b. APPLICATION: Poured Concrete, Steel Pan, Terrazzo.
   c. TREAD: Ribbed Bar Abrasive.
   d. WIDTH: 4 inches.
   e. MOUNTING: Mechanically fastened.

C. Handrail Illumination Strips: Provide one of the following:
1. No 1204, Zero International.
2. EverGlow tape aluminum strips, Everglow.
3. No. 4010C-1 inch, Balco.
4. H5001, Ecoglo.

D. Perimeter, Demarcation Way Finding, and Obstacle Marker Illumination Strips, Strips: Provide one of the following:
1. No 1201, Zero International.
2. EverGlow tape aluminum strips, Everglow.
3. No. 4011C-1 inch, Balco.
4. H6001, Ecoglo.

E. Wall, door frame and hardware illumination strips: Provide one of the following:
1. No 1201 series, Zero International.
2. EverGlow tape aluminum strips, Everglow.
3. No. 4010C-1 inch, Balco.
4. H5001, Ecoglo.

F. Door Signage.
   1. No 1230 series, Zero International.
   2. EverGlow signs and markers, Everglow.
   3. 1500 series, Balco.
   4. Ecoglo pathmarking door signs, Ecoglo.

G. Directional Signage.
   1. No 1220 series, Zero International.
   2. EverGlo signs and markers, Everglo.
   3. 1500 series, Balco.
   4. Ecoglo pathmarking signs, Ecoglo.

2.4 FABRICATION

A. Stair Tread and Landing Nosing: Fabricate stair tread and landing nosing assemblies of extruded aluminum with photoluminescent and abrasive strips factory installed in extrusions. Provide anchors and accessories indicated in the installation instructions and necessary for complete installation.
   1. Provide abrasive treads of color selected form manufacturer's standard colors.
   2. Provide specified anchors and where required, tread plate securing screws.
   3. provide surfaces in contact with concrete coated with a clear acrylic lacquer.

B. Fabricate handrail illumination strips and other illumination strips, using phosphorescent pigment, combined with a carrier/fixer that is cross-linked to an aluminum substrate at high temperature.

PART 3 - EXECUTION

3.1 LOCATIONS

A. Install photoluminescent exit path marking systems at new stairs, at existing stairs at Elevator Core Tower Stair and where indicated.

3.2 INSPECTION

A. Examine all surfaces to receive the parts of the work specified herein. Verify all dimensions of in-place and subsequent construction. Installation of photoluminescent exit path markings constitutes acceptance of existing conditions.

3.3 PREPARATION

A. Install the photoluminescent exit path marking systems in each exit stair and in locations shown on the Drawings in accordance with the manufacturer's installation instructions and the final reviewed shop drawings, anchoring securely to supporting construction with fasteners as recommended by manufacturer.

3.4 INSTALLATION

A. Stair Tread and Landing Nosing: Stair tread and landing leading edge nosing rigidly anchored to the substrate. Install the full length of each step and landing edge in accordance with the local code requirements.

1. See Section 05 51 13 "Metal Pan Stairs" for installation.

B. Handrail Illumination Strips: Adhered to the handrails in accordance with the local code requirements with the factory applied pressure sensitive adhesive.
   1. Placed strips on the top surface of the handrail for the entire length of the handrail, including handrail extensions and newel post caps.
   2. At bends or corners, provide stripe as continuous as practicable with no more than a 4 inch gap in the photoluminescent strip.

C. Demarcation Way Finding Strips shall be adhered in accordance with the established code requirements with the factory approved adhesive. Strips shall be as continuous as practicable with no more than a 4 inches gap in the photoluminescent strip.
   1. Floor mounted option: shall be positioned as close to the wall as practicable but no more than 4 inches away from the wall. Extend to within 2 inches of the leading edge nosing. Extend across the floor in front of obstacles. Continue across all doors except door frames marked as intermediate and final exit doors.
   2. Wall mounted option: Place bottom edge is no more than 4 inches above the finished floor. At the top and bottom of the stairs, demarcation lines shall drop vertically to the floor within 2 inches of the leading edge nosing. Transition demarcation vertically to the floor and then extend across the floor where a line on the floor is the only practical method of outlining the path. Continue demarcation across all doors, or transition to the floor and extend across the floor in front of the door, except doors marked as intermediate exit doors and doors marked as final exit doors.

D. Obstacle Markings shall be adhered to the obstruction in accordance with the established code requirements.
   1. Mark all obstacles at or below for 6'-6" in height and projecting more than 4" into the egress path.

E. Door Signage shall be located and adhered in accordance with the established code requirements and placed at a maximum height from the floor of 18".
   1. Intermediate exit doors and final exit doors:
      a. Intermediate exit doors are doors that lead from a vertical exit, horizontal extension in a vertical exit, horizontal exit, supplemental vertical exit, or exit passageway, but do not lead directly to the exterior or to a street level lobby.
      b. Final exit doors are doors that lead directly to the exterior or a street level lobby.
      c. Final exit doors are doors that lead directly to the exterior or a street level lobby.
      d. Mount signs on the center of the door.
      e. Door hardware shall be marked with no less than 16 square inches of photoluminescent material and the photoluminescent material shall be located behind, immediately adjacent to, or on the door adjacent to, or on the door handle and/or escutcheon. Panic bars shall have a minimum 1" x 16" photoluminescent strip along their entire length. The strip shall be mounted adjacent to the panic bar but not impede its operation.
      f. The top and sides of the door frames shall be marked with a solid and continuous 1" wide photoluminescent strip with a factory approved

adhesive. Strip is permitted to be installed on the wall surrounding the door frame

3.5 CLEANING AND PROTECTION

A. Clean exposed surfaces as recommended by the manufacturer.

B. Protect installed product from damage during final construction phase. Do not allow heavy objects to come in contact with the installed products.

END OF SECTION

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SECTION 10 82 13

EXTERIOR GRILLES AND SCREENS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Perforated galvanized steel sheet exterior decorative screens.
2. Metal mesh fall protection screens.

B. Related Sections:
1. Section 05 50 00 “Metal Fabrications” for framing and supports for exterior grilles and screens.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, exterior screen Installer, exterior screen manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects exterior screens, 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 exterior screen 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 exterior screens.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for exterior screen assembly during and after installation.
8. Review of procedures for repair of exterior screens damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings:
1. Include fabrication and installation layouts of exterior screens; 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 (1:10).

C. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:
1. Exterior screens: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other exterior screen accessories.

1.4 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.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For exterior screens to include in maintenance manuals.

1.6 QUALITY ASSURANCE

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

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build mockup of typical exterior screen assembly as shown on Drawings or if not shown, minimum 10 feet long section full height, including corner, supports, attachments, and accessories.
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.

1.7 DELIVERY, STORAGE, AND HANDLING

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

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

C. Stack exterior screens horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store exterior screens to ensure dryness,

with positive slope for drainage of water. Do not store exterior screens in contact with other materials that might cause staining, denting, or other surface damage.

1.8 FIELD CONDITIONS

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

1.9 COORDINATION

A. Coordinate exterior screen 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 exterior screen systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.

B. Structural Performance: Provide exterior screen systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
   1. Wind Loads: As indicated on Drawings and in the Cladding Wind Load Study.
   2. Other Design Loads: As indicated on Drawings.
   3. Deflection Limits: For wind loads, no greater than 1/360 of the span.
   4. Seismic design: Seismic Data as indicated on the drawings.

C. 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 EXTERIOR DECORATIVE SCREEN PANELS

A. General: Provide factory-formed perforated metal screen panels. Include accessories required for installation.

B. Perforated Metal Screen: Galvanized-steel sheet, ASTM A 653/A 653M, G90 (Z275) coating, commercial steel Type B.
   1. Basis-of-Design Product: Provide product with perforations matching existing exterior perforated panels.

C. Attachment system: Subject to compliance with the requirements, provide attachment hardware indicated on the Drawings.

2.3 FALL PROTECTION SCREEN PANELS

A. General: Reinstall salvaged screens, and provide factory-formed metal mesh screen panels matching those at the existing garage upper level. Include accessories required for installation.

B. Woven-Wire Mesh: Match existing metal mesh, rectangular, crimped pattern, and wire size, woven-wire mesh, made from wire complying with ASTM A 510 (ASTM A 510M).

C. Posts and attachment system: Subject to compliance with the requirements, provide posts and attachment hardware match existing.

2.4 MISCELLANEOUS MATERIALS

A. Steel support posts:
   1. See Section 05 12 00 "Structural Steel framing."

B. Steel items not shown on the Structural Drawings: Provide per requirements of Section 05 50 00 "Metal Fabrications."

C. Accessories: Provide components required for a complete, system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of exterior screens unless otherwise indicated.
   1. Closures: Provide closures at eaves and rakes, fabricated of same metal as exterior screens.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

D. Flashing and Trim: Provide flashing and trim formed from same material as exterior screens 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 exterior screens.

2.5 FABRICATION

A. General: Fabricate and finish exterior screens 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 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 exterior screen 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.

2.6 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 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. Shop-Painted Finish: Comply with Section 099600 "High-Performance Coatings."
   1. Color: Match existing exterior perforated panels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, exterior screen supports, and other conditions affecting performance of the Work.
   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

B. Examine roughing-in for components and systems penetrating exterior screens to verify actual locations of penetrations relative to seam locations of exterior screens 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 exterior screen manufacturer's written recommendations.

3.3 EXTERIOR SCREEN INSTALLATION

A. General: Install exterior screens according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor exterior screens and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving exterior screens.
   2. Flash and seal exterior screens 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 exterior screens 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 exterior screen work proceeds.

B. Fasteners:
   1. Galvanized-Steel: Use galvanized-steel fasteners.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by exterior screen manufacturer.

D. 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 exterior screen system including trim, copings, corners, seam covers, flashings, fillers, closure strips, and similar items. Provide types indicated by exterior screen manufacturer; or, if not indicated, provide types recommended by exterior screen manufacturer.

E. 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 achieve waterproof performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) 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 (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

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

B. Remove and replace metal wall 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.

3.5 CLEANING AND PROTECTION

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

B. After exterior screen installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

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

END OF SECTION

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